"ANTHROPOMETRIC STUDY OF FACIAL & NASAL PARAMETERS AMONG LUCKNOW POPULATION:A CROSS SECTIONAL STUDY "

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In

DEPARTMENT OF ORAL AND MAXILLOFACIAL PATHOLOGY AND ORAL MICROBIOLOGY

By

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BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES, LUCKNOW

(Faculty of Babu Banarasi Das University)

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I hereby declare that this dissertation entitled **"Anthropometric study of Facial & Nasal parameters among Lucknow population: A Cross sectional study"** is a bonafide and genuine research work carried out by me under the guidance of **Dr. JIJI GEORGE,** Professor & head, and **Dr. ABHILASHA SHUKLA** and **Dr. ANKITA SINGH,** Reader as Co-Guides. Department of Oral Pathology and Microbiology, Babu Banarasi Das College of Dental Sciences, Babu Banarasi Das University, Lucknow, Uttar Pradesh.

Date: 1/7/21

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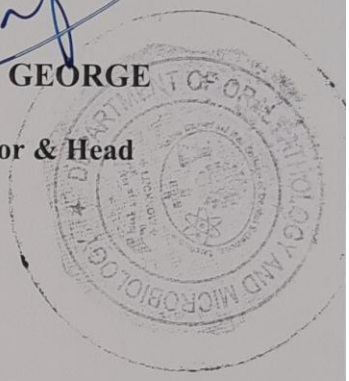

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I bow my head in front of God, the Almighty, for the endless shower of his blessings which always give me strength and courage to overcome anything and everything.

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Dr. Vandana Prasad

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ABBREVIATIONS

1. n = Nasion
2. pn = Pogonion
3. sn = Subnasale
4. gn = Gnathion
5. zy = Zygion
6. al = Ala
7. NH = Nasal Height
8. NL = Nasal Length
9. ND = Nasal Depth
10. NW = Nasal Width
11. FH = Facial Height
12. FW = Facial Width
13. etc = Et cetera
14. i.e = That is
15. ANS = Anterior Nasal Spine
16. PNS = Posterior Nasal Spine

Anthropometry is the measurement of human body. Face and nose are the most important features in humans. Nasofacial anthropometry is a specific component of the anthropometric field that focuses on the facial and nasal regions which is vital for sex determination, quantifying nasofacial dysmorphology, facial surgery, and diagnostic comprehension and also valuable in forensic reconstructions and identification of missing persons. Knowledge of nasal index in anthropology and forensic medicine is highly relevant in distinguishing ethnic group and sex of individuals. Anthropometry plays a pivotal role in industrial and fashion design, ergonomics and architecture. Two individuals are never alike in their measurable characters and hence study of intra and inter population variations are of importance in various fields. The present cross sectional study was conducted in the Department of Oral Pathology and Microbiology, Babu Banarasi Das College of Dental Sciences, BBD University, Lucknow. Study was done in **200** subjects with an age group of **18-35** years. This age group was selected, as age negligibly affects the facial parameters in subjects above 18 years. Nasal, Facial, Philtrum and Columella parameters were recorded using vernier calipers with accuracy of 0.01 mm. All the measurements were taken with the subject sitting on a chair in a well-illuminated room, in a relaxed condition with the head in the anatomical position. The facial muscles were relaxed in order not to alter the size of the nose or the philtrum. To reduce technical error of the measurements, each parameter was measured twice and average taken. The measurement was done by one observer to prevent inter-observer error. The outcome measures of the study were facial (facial length, facial width and facial index) and nasal (nasal height, nasal length, nasal depth, nasal width, columella width, philtrum length, phitrum width and nasal index) parameters. The outcome measures were assessed at the time of presentation. The facial length and width and nasal height,

length, depth and width were measured in millimetre (mm). Comparing the difference in mean facial index of two groups, Student's t test showed insignificant ($P > 0.05$) difference in facial index between the two groups it was 0.3% higher in males as compared to females. Comparing the frequency (%) distribution of face type of two groups, χ^2 test showed insignificant ($P > 0.05$) difference in face type between females and males ($\chi^2=5.50$, $P = 0.240$) i.e. found to be statistically the same. In females, the face type "hyperleptoprosopic" was the most prevalent. In males, the face type showed similar trend as of females with highest frequency of "hyperleptoprosopic.

The mean nasal index was comparatively higher in males than females. Comparing the difference in mean nasal index of two groups, Student's t test showed significantly ($P < 0.01$) different and higher (4.9%) nasal index of males as compared to females. The significant difference in nose type between two sex groups mainly attributed to 18.0% higher frequency of nose type "mesorrhine" in females than males.

Anthropometry comes from the Greek word “Anthropos” which means human and “metron” which means measure. According to the WHO, the anthropometry is an inexpensive and noninvasive technique for assessing the size, proportions, and composition of the human body.[1]Assessment of parameters in humans to understand their physical variations has been a long time practice.[2] The growth and development of humans are affected by many factors including geological, biological, geographical, racial, gender, and age.[3]Normal measurements for one group should not be considered so for other ethnic groups.[4]The morphological variations noted in different populations may be due to the proportion and type of genetic control that varies between individuals and groups. Hence, genetic factors have been proposed to exert substantial influence on the variations observed in the shape and configuration of the human face.[5]Environmental factors such as climate could influence facial height and width as well as nasal height and cranial width, and thus may be a contributing factor to the differences in facial features among populations.[6]The face and the nose are important physiognomic features in humans. Nasofacial anthropometry is a specific component of the anthropometric field that focuses on the facial and nasal regions which is also vital for sex determination, forensics uses, quantifying nasofacial dysmorphology, facial surgery, and diagnostic comprehension.[7]Face and nose are developed from frontonasal prominences, nasal prominences, and maxillary and mandibular prominences and final characteristic of the face depends mainly on the changes in the proportion and position of these facial components.[8]Assessment of sexual dimorphism is an essential component of anthropometry as it plays a pivotal role in industrial and fashion design, ergonomics and architecture; where geometrical data about the distribution of body dimensions in the population are used to optimize product dimensions.[9]

Due to international migration in the contemporary world, it is important for professionals from various medical and dental specialities to be aware of differences in facial characteristics among ethnic groups; especially those whose work involves correction of facial anomalies and enhancing aesthetics.[10]It can also be valuable in forensic reconstructions and identification of missing persons.[11] More effective and comfortable ergonomic products such as helmets, masks, eyeglasses and respirators can also be designed using the data.[12]With rise of COVID 19, use of well fitting mouth masks has become the norm. With the constantly evolving human racial features, anthropometric studies need to be undertaken from time to time. Hence we conceptualized this study titled "Anthropometric study of facial and nasal parameters among Lucknow population: A cross sectional study".

AIM:

The aim of the present study was to assess the anthropometric data of facial and nasal parameters among Lucknow population.

OBJECTIVES:

1. To determine the facial and nasal parameters of males in the population of Lucknow.
2. To determine the facial and nasal parameters of females in the population of Lucknow.
3. To compare the facial and nasal parameters of males from those of females in the population of Lucknow.

Anthropometry according to W.H.O, is an inexpensive and noninvasive technique for assessing the size, proportions, and composition of the human body that varies between individuals and races.[7] It comes from a Greek word "Anthropos" which means human and "metron" which means measure.[1] It deals with body measurements of size, shape, strength and working capacity.[13] Alphonse Bertillon (1853–1914) is considered the father of anthropometry.[14]

Anthropometry is used extensively for measuring the soft tissue proportions.[15] It is used in forensic science, for the purpose of understanding human physical variations and also plays an important role in industrial design, fashion design, ergonomics and architecture; where geometrical data about the distribution of body dimensions in the population are used to optimize product dimensions.[9] Anthropometry also helps in assessing sexual dimorphism in phenotypic characteristics of the same species.[16]

Physical anthropology deals with external measurements and descriptions of the human body and is used to classify races. Cephalometry is one of the important branches of physical anthropometry, which deals with measurement of dimensions of the head and face.[17]Due to international migration in the contemporary world, it became important for professionals from various medical and dental specialties to be aware of differences in facial characteristics among ethnic groups; especially those whose work involves correction of facial anomalies and enhancing aesthetics.[9]

Extensive use of anthropometric measurements and fit panels in establishing design and sizing requirements for respirators has been utilized and is available in the USA since 1973. A properly fit respirator is essential to the safety and health of workers who are employed in occupations that expose them to potential inhalation hazards and to emergency response personnel who may be called upon to respond in hazardous environments.[18]

In anthropology and forensic medicine, the knowledge of nasal index is highly relevant in distinguishing the ethnic group and sex of individuals with unknown identity.[19]Two persons are never alike in their measurable characters and hence study of intra and inter population variations is of importance in various fields.[20]

Nasofacial anthropometry is a specific component of the anthropometric field that focuses on the facial and nasal regions which is vital for sex determination, forensics uses, quantifying nasofacial dysmorphology, facial surgery, and diagnostic comprehension.[7]

Nasal anthropometry is the measurement of the different parameters of the nose. It is considered as one of the best clues to look for ethnic origin.[21]

Nasal index measurement in healthy individuals is also useful in the early diagnosis of some dysmorphic syndromes like cleft lip and cleft palate which are associated with nose disorders during human embryonic period.[22]

Nasal proportions are important in aesthetic and reconstructive surgery. Knowledge of the unique shape, anatomy and dimensions of the nose is very useful for surgeons undertaking its repair and reconstruction.[23]

The nasal index is also useful in the analysis of fossil remains as well as the study of living populations.[24]

Human nose influences facial aesthetics and soft tissue harmony. Owing to uniqueness of nasal morphological characteristics, it has been included in victim identification protocol of the investigative and forensic authorities by various countries.[25]

The comparison of the changes in facial index between parents, offsprings, and sibling can give the clue to genetic transmission of inherited characters.[26]

Accurate facial analysis such as facial height, facial width, and facial index is essential for the diagnosis of genetic and acquired anomalies for the study of normal and abnormal growth and morphometric investigations.[27]

The diversity of various measurements derived from nasofacial anthropometric studies can be used in criminological, clinical, eugenics anthropometry, forensic anthropology, syndromology and scientific research.[28]

Facial anthropometry can be used as predictive values & increasing susceptibility to obstructive sleep apnea (OSA) as euryprosopic facial type favors the nasal breathing mode.[29]Craniofacial characteristics have been determined in different patient groups with thalassemia, down syndrome, etc.[30]Facial expressions and parameters are considered primary tools to identify individuals.

Facial parameters that are commonly used are Facial width and Facial height.

a. Facial width = distance between two Zygions.
b. Facial height = distance between Nasion and Prosthion.[30]

Facial index = facial height / facial width X 100.[31]

Based on Banister'sclassification[57] of facial index, types of face are (All the measurements are in millimetres):

Hypereuryprosopic (very broad, short face)	X - 79.9
Euryprosopic (broad, short face)	80 – 84.9
Mesoprosopic (average face , round)	85 – 89.9
Leptoprosopic (tall, narrow face):	90 – 94.9
Hyperleptoprosopic (very tall, narrow face)	95 – X

Nasal parameters that are commonly used are nasal height, nasal length, nasal depth, nasal width, columella depth, philtrum length and philtrum width.

a. Nasal Height = from the nasion to the subnasale.[23]
b. Length of Nose = distance between nasion to a point at tip of the nose in line with the upper edge of both Nostrils.
c. Depth of Nose = from base of columella to a point at tip of Nose in line with the upper edge of both nostrils.
d. Width of Nose = from ala to ala (most lateral point on each alar contour).
e. Width of Columella of Nose = at middle portion of columella measured with a caliper.[2]

Nasal index can be calculated using the formula,

N.I.= Nasal width(NW) / Nasal height(NH) ×100.[32]

According to Wai MM[7] et al 2015 and Hegazy AA[23] et al 2014; types of nose are (All the measurements are in millimetres):

Hyperleptorrhine (excessively tall and narrow)	≤54.9
Leptorrhine (tall and narrow)	55.0–69.9
Mesorrhine (medium)	70.0–84.9
Platyrrhine (broad and flat)	85.0–99.9
Hyperplatyrrhine (excessively broad and flat)	≥100.0

It was observed that broader noses are favored in warm climates whereas narrower noses are favored in cold climates because long noses provide increased surface area for warming the air.[33]As humans are becoming more of a global community, the study of local adaptation has become more important to understanding health risks involved

in people living in foreign climates.[34]Racial differentiation can also be done based on nasal features.[19]

Philtrum Parameters

The philtrum of nose plays a key role in determining the appearance of upper lip and nostril. The philtrum, which is derived from the Greek word 'philtron' meaning "love potion" is the most characteristic feature of the upper lip.[35]

Philtrum parameters that are commonly used are Length of phitrum and width phitrum.

a. Length of philtrum = from base of columella to the midline depression of vermillion border.
b. Width of philtrum = distance between two points marked at the base of the philtrum i.e, at junction of vertical ridge of philtrum and vermillion border of upper lip.[2]

Morphological philtrum disorders occur in patients with cleft lip, secondary cleft lip, nose deformity and post tumor resection or trauma. A smooth philtrum is a characteristic feature of fetal alcohol syndrome.[36]

Different studies have been documented which indicate its major role in showing regional variations among populations and sexual dimorphism.

Rebar JE et al. 2004;[37]suggested that taking into consideration the increasing turbulent flow within respirators because they might allow available oxygen to bypass the mouth or contribute to a build up of carbon dioxide inside the mask if not properly made according to the facial features may increase resistance inside a respirator and

could therefore have an effect on the amount of time and rate at which one could perform work while wearing a respirator.

Facial anthropometry application for making respirators may significantly affect economic and distribution impact for respirator purchasers and suppliers who want to enhance the safety and health of persons who rely upon and use respirators with sizing scheme.

Zhuang Z et al. 2010;[38]reviewed facial anthropometric differences among gender, ethnicity, and age groups in US workforce and observed significant differences in anthropometric values between construction workers and other occupational groups even after gender, ethnicity, and age were taken into consideration.

The workers employed in manufacturing, firefighting, healthcare, law enforcement, and other occupational groups had the facial features that differed significantly than those in construction and could be important to the design and manufacture of respirators, as well as employers responsible for supplying respiratory protective equipment to their employees.

Eliakim-Ikechukwu C et al.[20]**2012, Omotoso DR et al.**[16]**2011, and Osunwoke EA et al.2011**;[29]carried out studies on Nigerian population on sexual dimorphism and significant difference was found between male and female facial indexes; this may be due to the male hormone testosterone which causes the changes in the shape of the face between the two sexes.

Sinha RS et al. 2012;[39]conducted naso-faciometric analysis in regional population Pune, Maharashtra and found positive correlation between facial height and subnaso-mental length and both parameters found more in males than females. They reviewed that researchers have also compared populations of different countries like India,

Nepal, China and Malaysia which are either neighbours or have shown inter racial mixing.

Sharma SK et al. 2014;[40]did a cross sectional study in Hindu community of Gwalior, India & concluded that predominant nose type to be mesorrhine though Nasal Index significantly higher in males than females which confirms the existence of sexual difference in nasal parameters possibly due to genetic, hormonal, nutrition and other related factors.

Hegazy AA et al. 2014;[23]perfomed a cross sectional anthropometric study of nasal index of Egyptians & found that most of Egyptian have the type of nose lying in the borderline between mesorrhine "medium" nose and leptorrhine "narrow" nose, for males and females respectively.

Asharani SK et al. 2015;[41]did a study and based on anthropometric study of nasal index among students in southern India assessed that the Indian population mainly has mesorrhine type of nose followed by platyrrhine and leptorrhine types.

Deulkar S et al. 2015;[42]performed a cross sectional study for the assessment of nose width in western Maharashtra population suggested that the Indian population, particularly western Maharashtra population has difference in width of nose because of racial and regional variations & the result showed that the Indian noses were broader than the white or Caucasian noses while the black or Negroid noses were the broadest.

Wai MM et al. 2015;[7]in their anthropometric cross-sectional study on three races of Malaysians revealed that Malay adults showed dominance of leptoprosopic face and mesorrhine nose. On comparison, Chinese adults predominantly had mesoprosopic face and mesorrhine nose whereas Indian adults had leptoprosopic face and mesorrhine nose and concluded that, anthropometric data of the face and nose

obtained would be useful for sex determination, forensics medicine, identifying nasofacial dysmorphology, and reconstructive facial and nasal surgeries. Also stated that more studies are needed in various fields of anthropometry within the Malaysian population to meet the demand in the medical and surgical fields.

Shah MRI et al. 2015;[43]performed an anthropometric study of the nose between adult male Santhals and Bengalis in Bangladesh & found that most of the Santhals were mesorrhine and Bengalis were leptorrhine.

Sinde SA et al. 2016;[44]found that there was larger facial measurements in Indian males revealing a clear sexual dimorphism.

Adelaja AA 2016;[45]conducted a cross sectional study in nasal biometrics and naso-facial proportions among Hausas and Yorubas of Nigeria & found that nasofacial proportions were lower in Hausas compared to Yorubas in both sexes, but values were similar in Yoruba males and females. Hausas revealed platyrrhine nose type while Yorubas showed mesorrhine nose.

Chettri MN et al. 2017;[46]performed a naso-facial anthropometric study in female Sikkimese University Students and found the average Nasal Index was found to be leptorrhine and the average facial Index were hyperleptoprosopic. They further made an effort to group the naso-facial measurements of female of Sikkim on the basis of ethnicity.

In a comparative study done in Bangladesh by **Chakraborty R et al. 2017;**[47]reported that the mean total length and protrusion of nose in Bengali children was significantly higher than Chakma ethnic group. Moreover, mean nasal index of Bengali was leptorrhine type and Chakma ethnicity showed mesorrhine type.

Pandey N et al. 2017;[48]reviewed an anthropometric study of facial index in medical students and found that the dominant type of face shape in males was mesoprosopic

followed by euriprosopic, leptoprosopic, hypereuriprosopic and hyperleptoprosopic. In females the dominant type of face was also mesoprosopic followed by hypereuriprosopic, euriprosopic, leptoprosopic and hyperleptoprosopic. The dominant phenotype in the studied population was mesoprosopic.

Adelakun SA et al. 2018;[49]reviewed an anthropometric study of nasal parameters in adult Oyemekun ethnic group in Akure Nigeria & the study showed that the mean nasal index of the Oyemekun ethnic group falls within the platyrrhine (broad nose) type.

Ravichandran S et al. 2018;[14]conducted a cross sectional study for gender determination in South India and found that the facial & nasal indices were greater in males than females.

Yadav SK et al. 2018;[2]performed a cross sectional anthropometric study of philtrum and nasal parameters in Nepal and found the male nasal index lies between leptorrhine and mesorrhine type whereas female nasal index is of mesorrhine type according to the classification of Nasal Index. All nasal dimensions are found to be sexually dimorphic.

Anthropometric Study among Medical Students in Tehran, Iran conducted by **Dodangreh M et al. 2018;**[30]found the predominant face type was hyperleptoprosopic and the values of facial features were higher in males than females.

Ernest MA et al. 2018;[50]performed a cross sectional anthropometric study to determine facial soft tissue among young adult Nigerians and concluded that the men had predominantly euryprosopic faces but the women had predominantly mesoprosopic faces.

Madadi S et al. 2019;[51]reviewed a study on estimation of stature from facial indices among Iranian medical students and they found that the dominant face shape in

females were euryprosopic, while in males it was mesoprosopic which indicates that female students have a rather broad face than male students, also the study showed that the prediction of facial width for stature estimation is more reliable than facial height among Iranian medical students, and the anthropometric features are affected by elements such as different races, nutrition, genetic and geographical situation, the regression models of the stature from other parts of body can be different in the various regions.

Sudikshya KC et al. 2019;[52]performed a cross sectional study of nasal and facial parameters among medical undergraduates of Nepalese and Indian origin and found that mesorrhine was the most common type in both the groups. Nepalese had euryprosopic type of face while Indians showed hypereuryprosopic face.

Jaberi KR et al. 2019;[31]performed a cross sectional study of nasofacial anthropometric study among students of Iran and concluded that most common type of face was hyperleptoprosopic and nose type was platyrrhine.

Review done by **Kulkarni MM et al. 2019;**[53]of nasal index in Baroda, Gujrat concluded that the mesorrhine is the commonest nasal type found in both sexes.

Kumar P et al.2020;[54]assessed the facial parameters among males of Haryana and Himachal Pradesh and found that facial height, width of bizygomatic arch and facial index were more in males from Haryana compared to those from Himachal and most of the subjects in both populations had hypereuryprosopic face.

Dhulqarnain AO et al. 2020;[55]compared nasal parameters among North western Nigerian and Northern Iranian Populations and found Nigerians had predominantly mesorrhine nose, while Iranians were leptorrhine; also the nasal index of males was higher in both populations.

Singla M et al. 2020;[17]did anthropometric cross sectional study on nasal parameters in adult jaunsari tribe population of Dehradun district of Uttarakhand, they found that the common nose type in females was leptorrhine, whereas in males both leptorrhine and mesorrhine type of nose were equally prevalent.

Prasanna PL et al. 2020;[56]conducted an anthropometric study of the Facial (Prosopic) Indices and stated that the data obtained may be useful in anthropological research, forensics, genetic research, as well as in clinical medical and dental practice (reconstructive surgery).

The present cross sectional study was conducted in the Department of Oral Pathology and Microbiology, Babu Banarasi Das College of Dental Sciences, BBD University, Lucknow. Study was done in **200** subjects with an age group of **18-35** years. This age group was selected, as age negligibly affects the facial parameters in subjects above 18 years of age. Random sampling was done. Healthy individuals with no visible disfigurement of face were included in the study after an informed consent. Subjects with disfigured face / trauma of the nose / congenital facial malformations as well as subjects with the history of having undergone cleft lip surgeries, reconstructive surgeries or plastic surgeries of the face were excluded from the study.

Age was recorded from the date of birth mentioned in his / her records. Subjects were examined for routine check-up, height measured using a measuring tape and nasal, facial and philtrum parameters were recorded using vernier calipers with accuracy of 0.01 mm. All the measurements were taken with the subject sitting on a chair in a well-illuminated room, in a relaxed condition with the head in the anatomical position. The facial muscles were relaxed in order not to alter the size of the nose or the philtrum. To reduce technical error of the measurements, each parameter was measured twice and average taken. The measurement was done by one observer to prevent inter-observer error.

Methodology for recording facial parameters

- **Height of face:** Measured as a straight distance between nasion and gnathion.
- **Width of face:** Measured as a distance between zygion and zygion.
- **Facial Index** will be calculated by: Facial Index = (Facial length/Facial width) X 100.

Based on Banister's classification[57] of Facial Index, types of face are classified as (All the measurements are in millimeters):

Hypereuryprosopic (very broad, short face): X - 79.9

Euryprosopic (broad, short face): 80 – 84.9

Mesoprosopic (average face, round): 85 – 89.9

Leptoprosopic (tall, narrow face): 90 – 94.9

Hyperleptoprosopic (very tall, narrow face): 95 – X

Methodology for philtrum measurements

- **Length of Philtrum-** From the base of columella to the midline depression of vermillion border.
- **Width of Philtrum-** Two points were marked at the base of the philtrum; at junction of vertical ridge of philtrum and vermillion border of upper lip. The width between these points was taken as the philtrum width.

Methodology for recording nasal parameters

- **Nose Height:** Measured from nasion to sub nasale
- **Length of Nose:** Distance between nasion to a point at tip of the nose in line with the upper edge of both nostrils.
- **Depth of Nose:** Distance from base of columella to a point at tip of Nose in line with the upper edge of both nostrils.
- **Width of Nose:** Measured from ala to ala (most lateral points on each alar contour)
- **Width of Columella of Nose:** Measured at middle portion of columella with a caliper.

- **Nasal index** will be calculated by: Nasal Index= (Nasal width/Nasal Height) X 100.

Classification of Nasal Parameters according to Wai MM[7] et al 2015 and Hegazy AA[23] et al 2014 are (All the measurements are in millimeters):

Hyperleptorrhine (excessively tall and narrow) ≤54.9

Leptorrhine (tall and narrow) 55.0–69.9

Mesorrhine (medium) 70.0–84.9

Platyrrhine (broad and flat) 85.0–99.9

Hyperplatyrrhine (excessively broad and flat) ≥100.

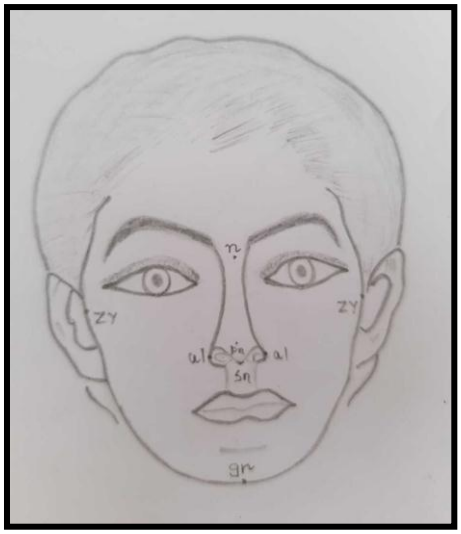


FIGURE 1: Facial & Nasal points of measurements

FH = Nasion(n) – Gnathion(gn)

FW = Zygoma(zy) – Zygoma(zy)

NH = Nasion(n) – Subnasale(sn)

NL = Nasion(n) – Pronasale(pn)

NW = Ala(al) – Ala(al)

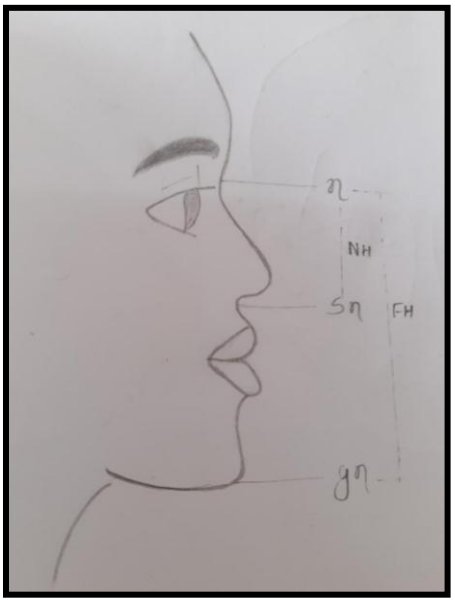


FIGURE 2: Points of measurement (Nasal height & Facial height)

NH = Nasion(n) - Subnasale(sn)

FH = Nasion(n) - Gnathion(gn)

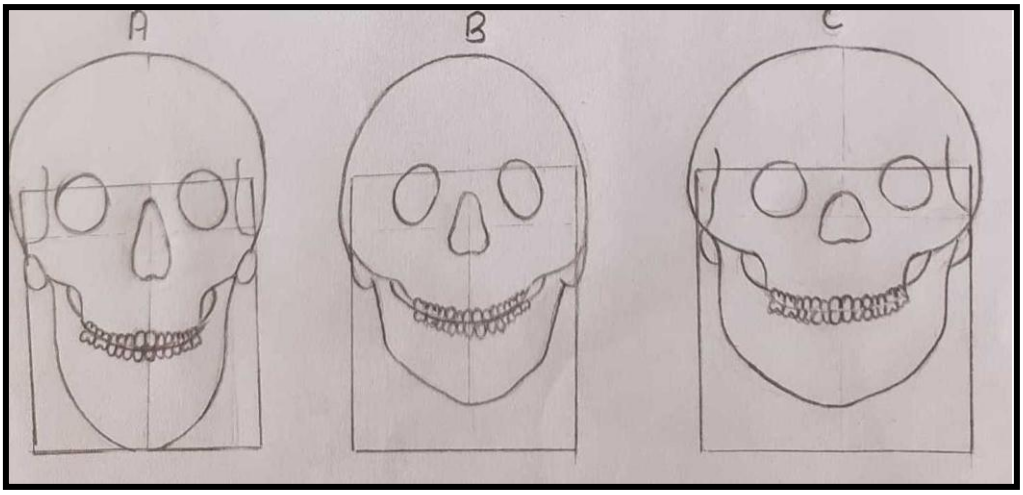


FIGURE 3: TYPES OF FACE

A-LEPTOPROSOPIC

B-MESOPROSOPIC

C-EURYPROSOPIC

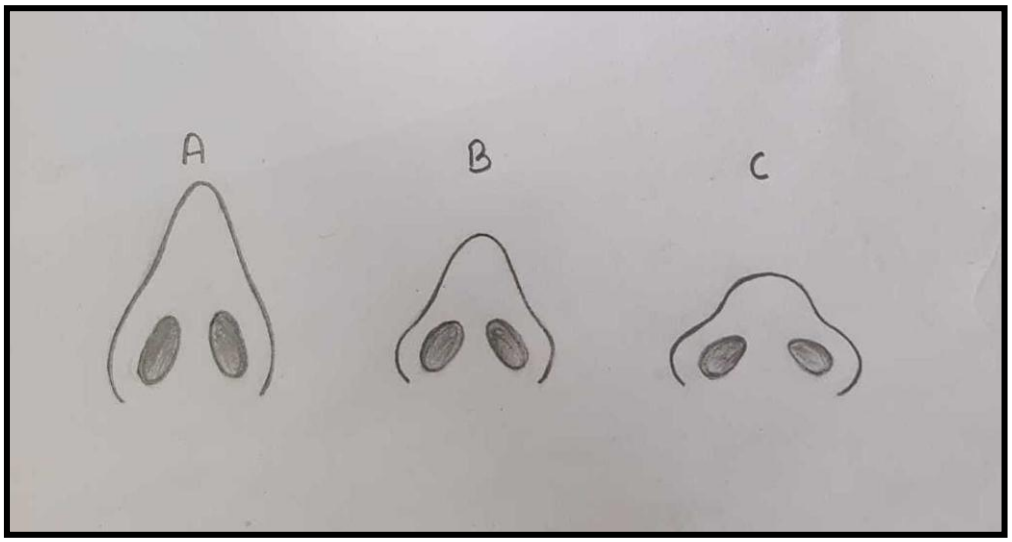


FIGURE4: TYPES OF NOSE

A-LEPTORRHINE

B-MESORRHINE

C-PLATYRRHINE

FIGURE 5: Measurement of facial length

FIGURE 6: Measurement of facial width

FIGURE 7:Measurement of philtrum length

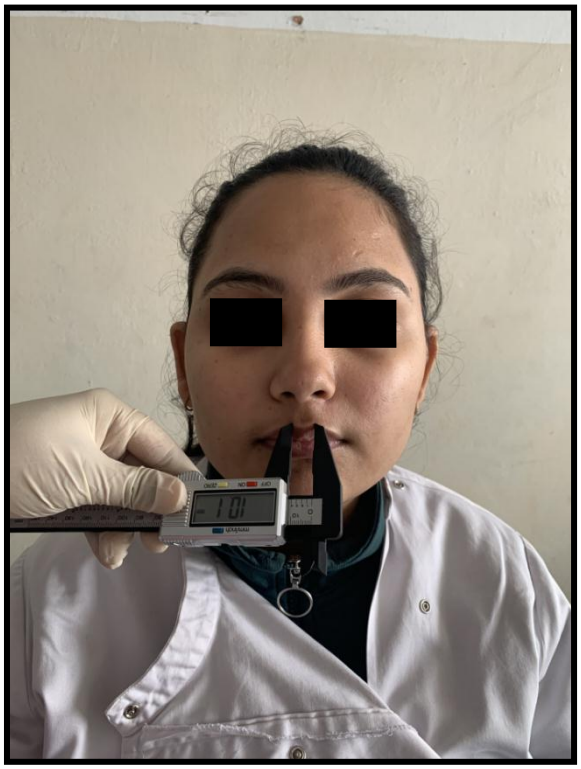


FIGURE 8:Measurement of philtrum width

FIGURE 9:Measurement of nasal height

FIGURE 10:Measurement of nasal length

FIGURE 11:Measurement of nasal width

FIGURE 12:Measurement of nasal depth

FIGURE 13: Measurement of columella width

The present anthropometric study evaluates facial and nasal parameters among Lucknow population. Total 200 subjects (100 females and 100 males) age between 18-35 yrs was recruited. The outcome measures of the study were facial (facial length, facial width and facial index) and nasal (nasal height, nasal length, nasal depth, nasal width, columella width, philtrum length, phitrum width and nasal index) parameters. The outcome measures were assessed at the time of presentation (enrolment). The facial length and width and nasal height, length, depth and width were measured in millimetre (mm).

The primary objective of the study was to compare the facial and nasal parameters between females and males. The secondary objective of the study was to assess and compare the facial and nasal type between two sex groups.

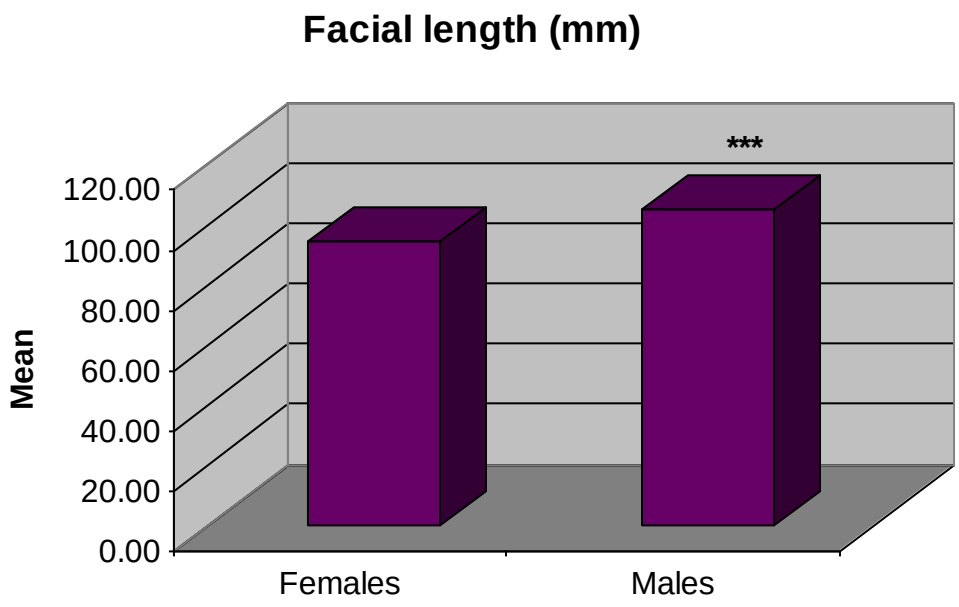
A. Facial parameters

The facial parameters (facial length, facial width and facial index) of two groups (females and males) is summarised in Table 1 and also shown in Fig. 1-3, respectively.

Table 1: Summary of facial parameters of two sex groups

Facial parameters	**Females (n=100)**	**Males (n=100)**	**Mean diff**	**t value**	***P* value**
Facial length (mm)	94.44 ± 8.28	105.15 ± 7.54	10.71	9.56	<0.001
Facial width (mm)	102.61 ± 6.65	114.07 ± 8.11	11.46	10.92	<0.001
Facial index (%)	92.14 ± 6.96	92.45 ± 7.21	0.31	0.31	0.758

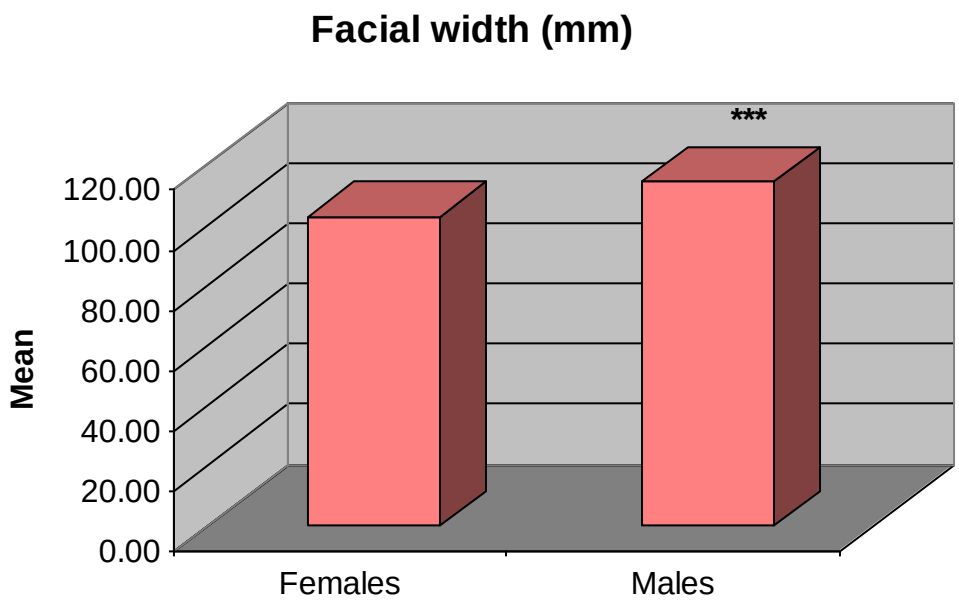
The facial parameters of two groups were summarised in Mean ± SD and compared by Student's t test (t value).



Graph 1. Bar graphs showing comparison of difference in mean facial length between two sex groups.

$^{***}P < 0.001$- as compared to Females. The facial length in females ranged from 81-116 mm with mean (± SD) 94.44 ± 8.28 mm and median 94 mm whereas in males it ranged from 90-121 mm with mean (± SD) 105.15 ± 7.54 mm and median 105 mm. The mean facial length of males was comparatively higher than females.

Comparing the difference in mean facial length of two groups, Student's t test showed significantly ($P < 0.001$) different and higher (10.2%) facial length of.71 mm, t=9.56, $P < 0.001$) (Table 1 and Fig. 1).

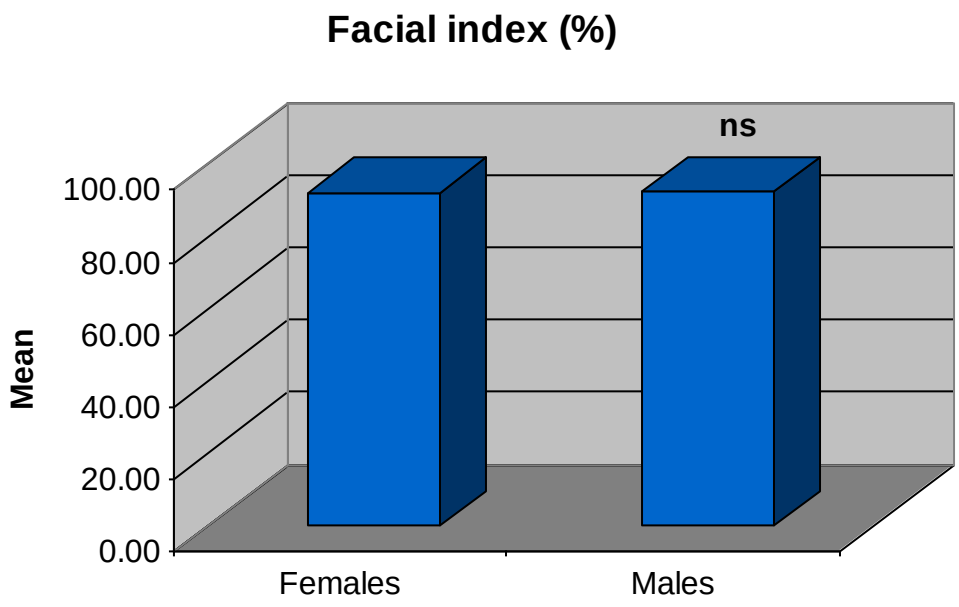


Graph 2. Bar graphs showing comparison of difference in mean facial width between two sex groups.

$^{***}P < 0.001$- as compared to Females.

The facial width in females ranged from 89-119 mm with mean (± SD) 102.61 ± 6.65 mm and median 103 mm whereas in males it ranged from 90-129 mm with mean (± SD) 114.07 ± 8.11 mm. Like facial length, the mean facial width was also comparatively higher in males than females.

Comparing the difference in mean facial width of two groups, Student's t test further showed significantly ($P < 0.001$) different and higher (10.0%) facial width of males as compared to females (102.61 ± 6.65 mm vs. 114.07 ± 8.11 mm, mean difference=11.46 mm, t=10.92, $P < 0.001$) (Table 1 and Fig. 2).



Graph 3. Bar graphs showing comparison of difference in mean facial index between two sex groups.

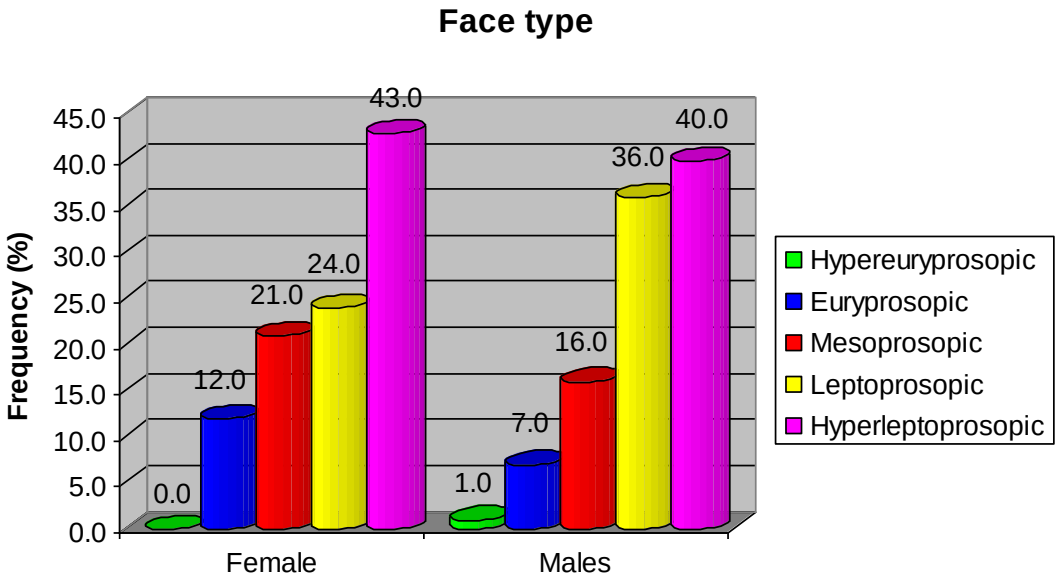
$^{ns}P > 0.05$- as compared to Females.

The facial index in females ranged from 80-108% with mean (± SD) 92.14 ± 6.96% and median 90% whereas in males it ranged from 77-111% with mean (± SD) 92.45 ± 7.21% and median 90%. The mean facial index was slightly higher in males than females. Comparing the difference in mean facial index of two groups, Student's t test showed insignificant ($P > 0.05$) difference in facial index between the two groups (92.14 ± 6.96% vs. 92.45 ± 7.21%, mean difference=0.31%, t=0.31, $P = 0.758$) though it was 0.3% higher in males as compared to females (Table 1 and Fig. 3).

Table 2: Frequency distribution of facial type of two sex groups

Facial type	**Females (n=100) (%)**	**Males (n=100) (%)**	**χ^2 value**	***P* value**
Hypereuryprosopic	0 (0.0)	1 (1.0)	5.50	0.240
Euryprosopic	12 (12.0)	7 (7.0)		
Mesoprosopic	21 (21.0)	16 (16.0)		
Leptoprosopic	24 (24.0)	36 (36.0)		
Hyperleptoprosopic	43 (43.0)	40 (40.0)		

The frequency distribution of facial type of two groups is summarised in number (n) and percentage (%) and compared by χ^2 test (χ^2 value). Comparing the frequency (%) distribution of face type of two groups, χ^2 test showed insignificant ($P > 0.05$) difference in face type between females and males ($\chi^2=5.50$, $P = 0.240$) i.e. found to be statistically the same (Table 2 and Fig. 4).



Graph 4. Frequency distribution of face type of two sex groups.

In females, the face type "hyperleptoprosopic" was the most prevalent (43.0%) followed by "leptoprosopic" (24.0%), "mesoprosopic" (21.0%), euryprosopic (12.0%) and "hypereuryprosopic" (0.0%) the least. In males, the face type showed similar trend as of females with highest frequency of "hyperleptoprosopic" (40.0%) followed by "leptoprosopic" (36.0%), "mesoprosopic" (16.0%), euryprosopic (7.0%) and "hypereuryprosopic" (1.0%) the least.

B. Nasal parameters

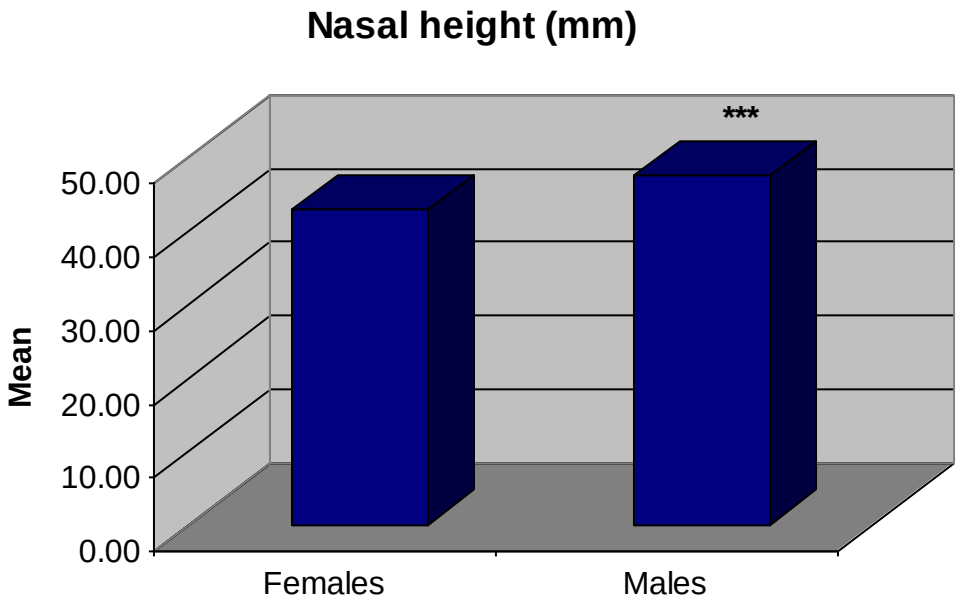
The nasal parameters (nasal height, nasal length, nasal depth, nasal width, columella width, philtrum length, philtrum width and nasal index) of two groups (females and males) is summarised in Table 3 and also shown in Fig. 5-12, respectively.

Table 3: Summary of nasal parameters of two sex groups

Nasal parameters	**Females (n=100)**	**Males (n=100)**	**Mean diff**	**t value**	***P* Value**
Nasal height (mm)	42.79 ± 4.48	47.33 ± 4.12	4.55	7.47	<0.001
Nasal length (mm)	37.18 ± 4.58	42.74 ± 4.59	5.56	8.56	<0.001
Nasal depth (mm)	12.62 ± 3.99	15.96 ± 3.73	3.34	6.11	<0.001
Nasal width (mm)	32.66 ± 3.96	38.02 ± 5.13	5.36	8.28	<0.001
Columella width (mm)	6.18 ± 2.10	7.81 ± 1.98	1.64	5.67	<0.001
Philtrum length (mm)	9.41 ± 2.98	10.43 ± 2.72	1.02	2.52	0.013
Philtrum width (mm)	8.78 ± 2.46	10.24 ± 2.52	1.45	4.12	<0.001
Nasal index (%)	76.47 ± 6.62	80.42 ± 9.43	3.96	3.43	0.001

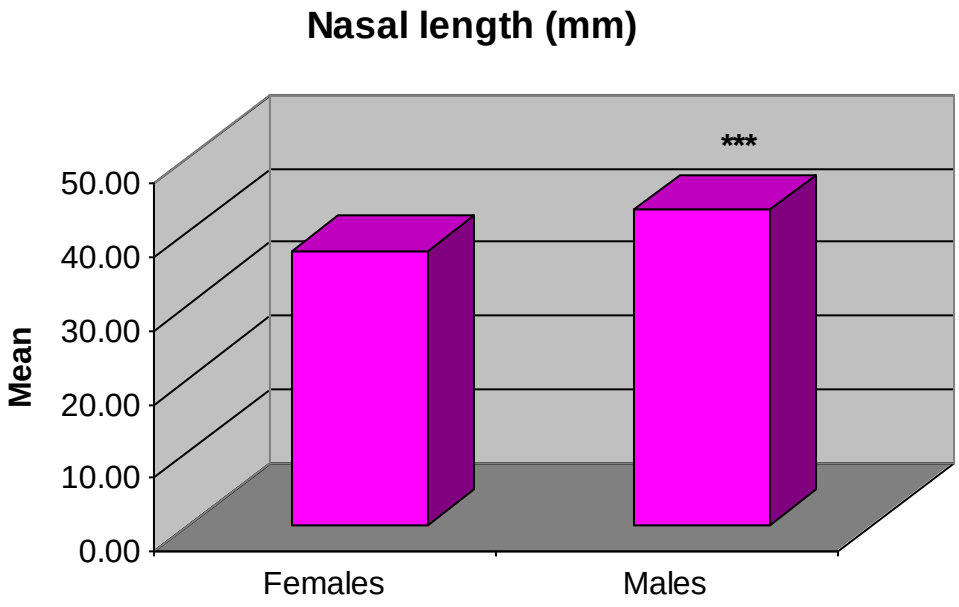
The nasal parameters of two groups were summarised in Mean ± SD and compared by Student's t test (t value).

The nasal index in females ranged from 60-92% with mean (± SD) 76.47 ± 6.62% and median 76% whereas in males it ranged from 63-111% with mean (± SD) 80.42 ± 9.43% and median 80%. The mean nasal index was comparatively higher in males than females. Comparing the difference in mean nasal index of two groups, Student's t test showed significantly ($P < 0.01$) different and higher (4.9%) nasal index of males as compared to females (76.47 ± 6.62% vs. 80.42 ± 9.43%, mean difference=3.96%, t=3.43, $P = 0.001$) (Table 3 and Fig. 12).



Graph 5. Bar graphs showing comparison of difference in mean nasal height between two sex groups.

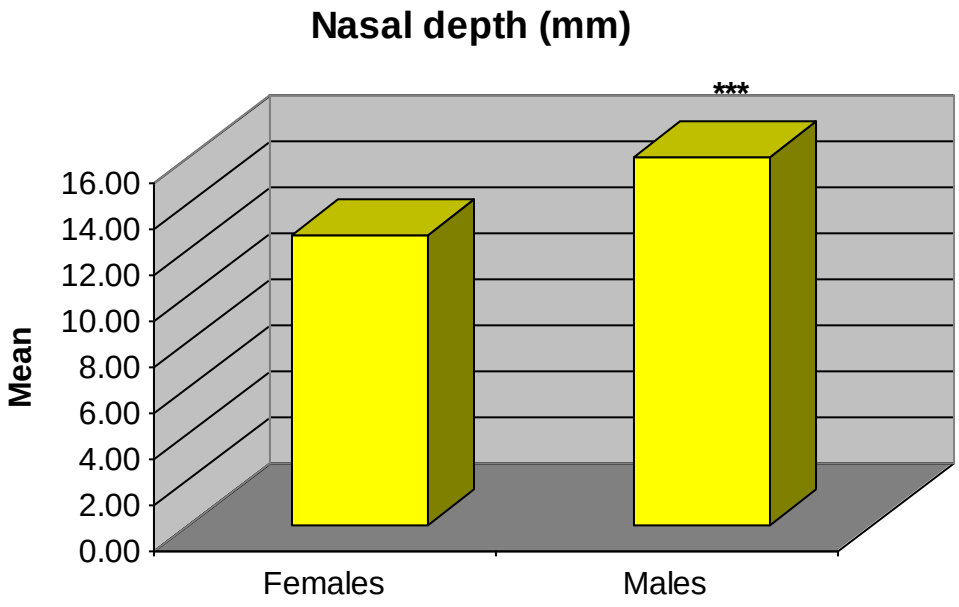
$^{***}P < 0.001$- as compared to Females. The nasal height in females ranged from 26-53 mm with mean (± SD) 42.79 ± 4.48 mm and median 43 mm whereas in males it ranged from 36-60 mm with mean (± SD) 47.33 ± 4.12 mm and median 47 mm. The mean nasal height was comparatively higher males than females. Comparing the difference in mean nasal height of two groups, Student's t test showed significantly ($P < 0.001$) different and higher (9.6%) nasal height of males as compared to females (42.79 ± 4.48 mm vs. 47.33 ± 4.12 mm, mean difference=4.55 mm, t=7.47, $P < 0.001$) (Table 3 and Fig. 5).



Graph 6. Bar graphs showing comparison of difference in mean nasal length between two sex groups.

$^{***}P < 0.001$- as compared to Females

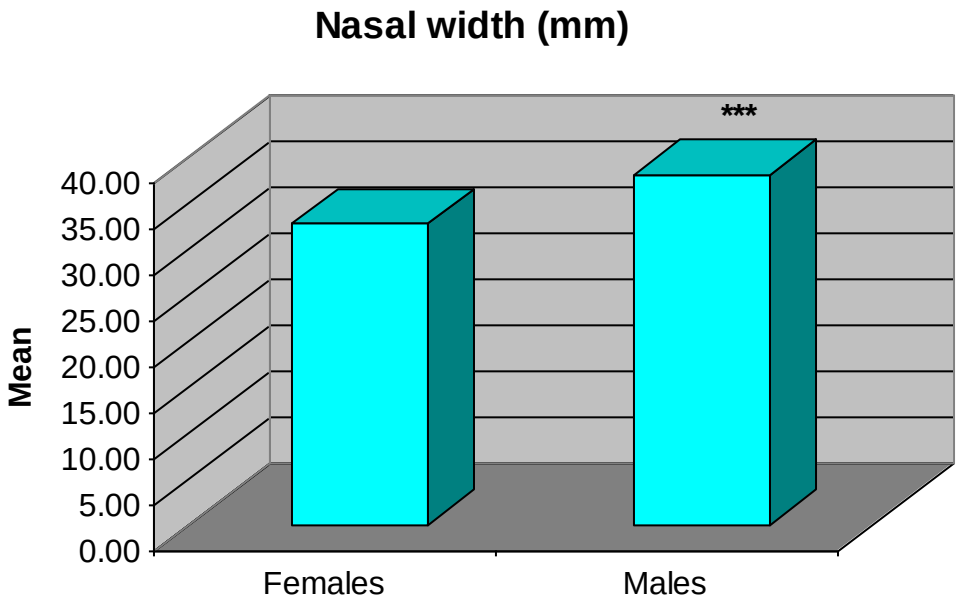
Nasal length in females ranged from 27-46 mm with mean (± SD) 37.18 ± 4.58 mm and median 37 mm whereas in males it ranged from 28-52 mm with mean (± SD) 42.74 ± 4.59 mm and median 43 mm. The mean nasal length was also comparatively higher in males than females. Comparing the difference in mean nasal length of two groups, Student's t test showed significantly ($P < 0.001$) different and higher (13.0%) nasal length of males as compared to females (37.18 ± 4.58 mm vs. 42.74 ± 4.59 mm, mean difference=5.56 mm, t=8.56, $P < 0.001$) (Table 3 and Fig. 6).



Graph 7. Bar graphs showing comparison of difference in mean nasal depth between two sex groups.

$^{***}P < 0.001$- as compared to Females.

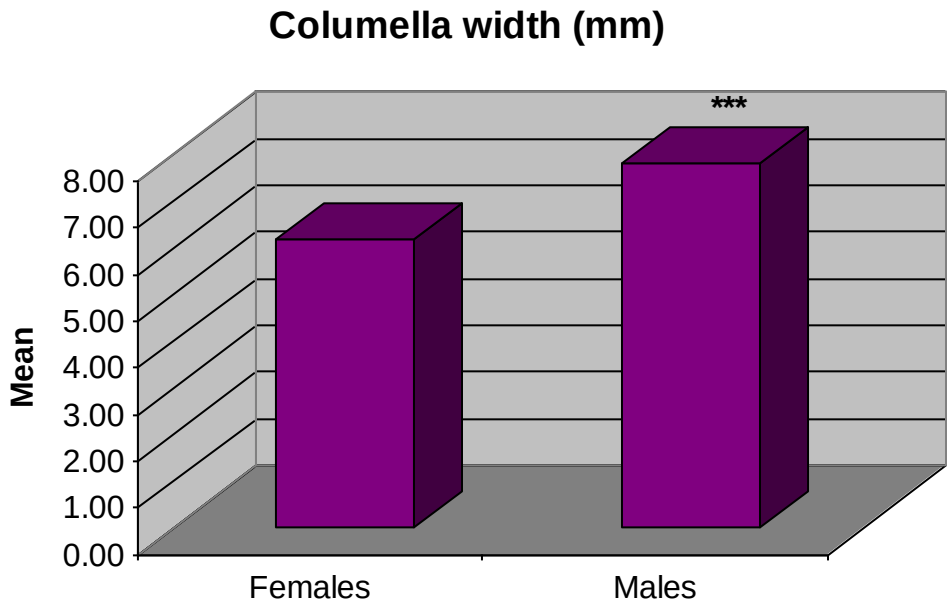
The nasal depth in females ranged from 3-20 mm with mean (± SD) 12.62 ± 3.99 mm and median 13 mm whereas in males it ranged from 6-24 mm with mean (± SD) 15.96 ± 3.73 mm and median 16 mm. The mean nasal depth was also comparatively higher in males than females. Comparing the difference in mean nasal depth of two groups, Student's t test showed significantly ($P < 0.001$) different and higher (20.9%) nasal depth of males as compared to females (12.62 ± 3.99 mm vs. 15.96 ± 3.73 mm, mean difference=3.34 mm, t=6.11, $P < 0.001$) (Table 3 and Fig. 7).



Graph 8. Bar graphs showing comparison of difference in mean nasal width between two sex groups.

$^{***}P < 0.001$- as compared to Females.

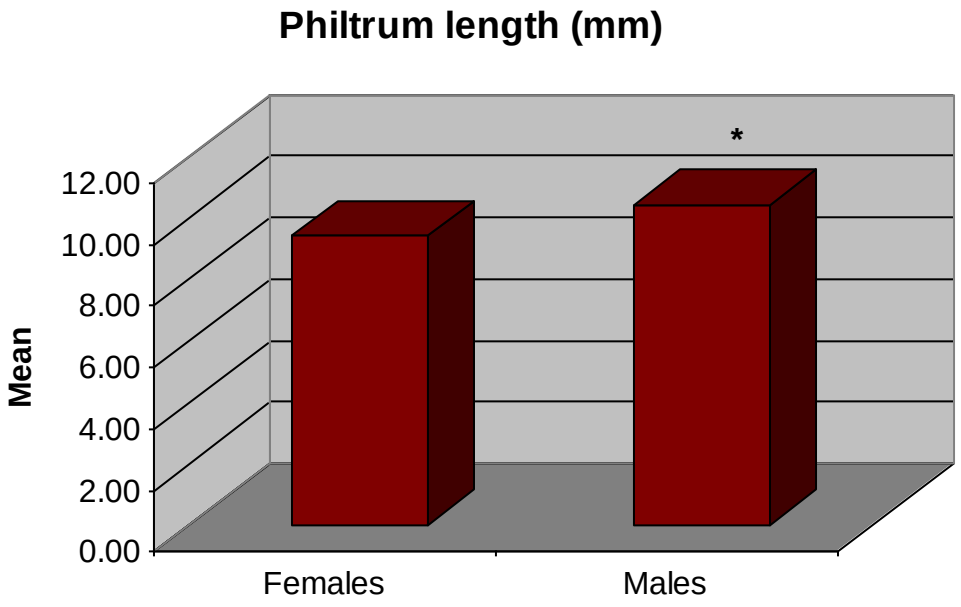
Comparing the difference in mean nasal width of two groups, Student's t test showed significantly ($P < 0.001$) different and higher (14.1%) nasal width of males as compared to females (32.66 ± 3.96 mm vs. 38.02 ± 5.13 mm, mean difference=5.36 mm, t=8.28, $P < 0.001$) (Table 3 and Fig. 8).



Graph 9. Bar graphs showing comparison of difference in mean columella width between two sex groups.

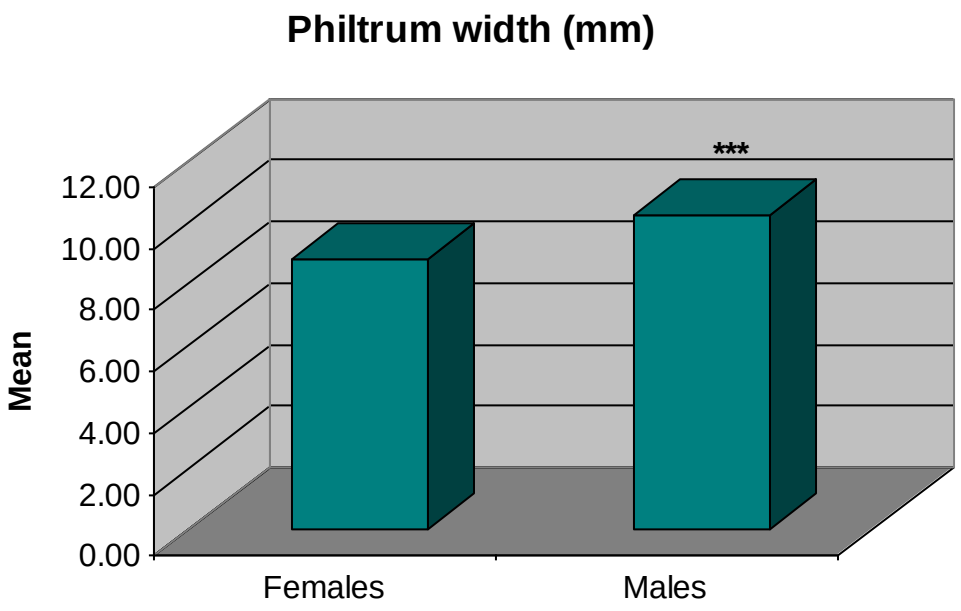
$^{***}P < 0.001$- as compared to Females.

The columella width in females ranged from 0-10 mm with mean (± SD) 6.18 ± 2.10 mm and median 6 mm whereas in males it ranged from 2-13 mm with mean (± SD) 7.81 ± 1.98 mm and median 8 mm. The mean columella width was also comparatively higher in males than females. Comparing the difference in mean columella width of two groups, Student's t test showed significantly ($P < 0.001$) different and higher (20.9%) columella width of males as compared to females (6.18 ± 2.10 mm vs. 7.81 ± 1.98 mm, mean difference=1.64 mm, t=5.67, $P < 0.001$) (Table 3 and Fig. 9).



Graph 10. Bar graphs showing comparison of difference in mean philtrum length between two sex groups.

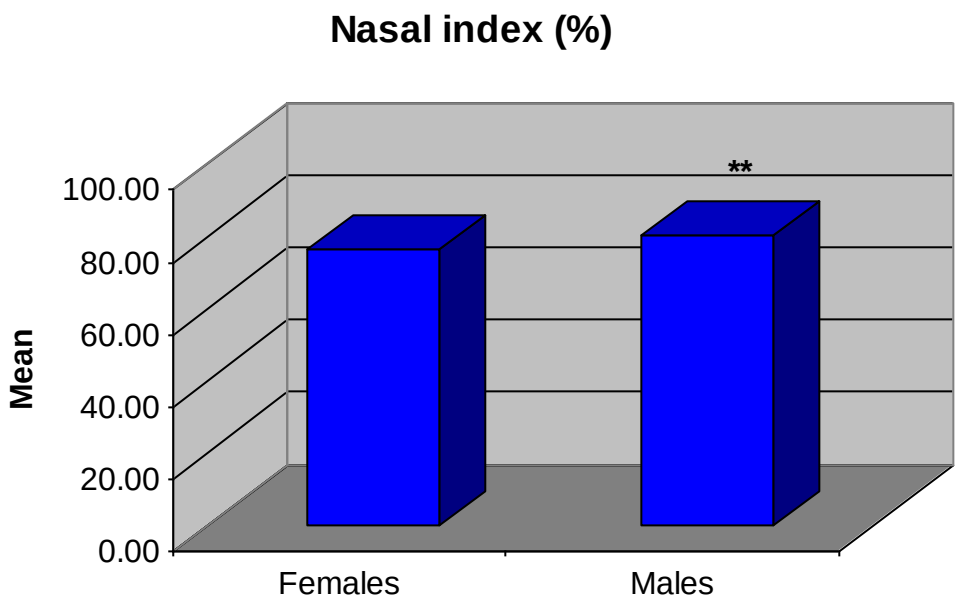
*P < 0.05- as compared to Females. the philtrum length in females ranged from 2-16 mm with mean (± SD) 9.41 ± 2.98 mm and median 10 mm whereas in males it ranged from 2-16 mm with mean (± SD) 10.43 ± 2.72 mm and median 10 mm. The mean philtrum length was also slightly higher in males than females. Comparing the difference in mean philtrum length of two groups, Student's t test showed significantly (P < 0.05) different and higher (9.7%) philtrum length of males as compared to females (9.41 ± 2.98 mm vs. 10.43 ± 2.72 mm, mean difference=1.02 mm, t=2.52, P = 0.013) (Table 3 and Fig. 10).



Graph 11. Bar graphs showing comparison of difference in mean philtrum width between two sex groups.

$^{***}P < 0.001$- as compared to Females.

The philtrum width in females ranged from 2-13 mm with mean (± SD) 8.78 ± 2.46 mm and median 9 mm whereas in males it ranged from 2-16 mm with mean (± SD) 10.24 ± 2.52 mm and median 10 mm. The mean philtrum width was also comparatively higher in males than females. Comparing the difference in mean philtrum length of two groups, Student's t test showed significantly ($P < 0.001$) different and higher (14.2%) philtrum length of males as compared to females (8.78 ± 2.46 mm vs. 10.24 ± 2.52 mm, mean difference=1.45 mm, t=4.12, $P < 0.001$) (Table 3 and Fig. 11).



Graph 12. Bar graphs showing comparison of difference in mean nasal index between two sex groups.

$^{**}P < 0.01$- as compared to Females.

The nasal index in females ranged from 60-92% with mean (± SD) 76.47 ± 6.62% and median 76% whereas in males it ranged from 63-111% with mean (± SD) 80.42 ± 9.43% and median 80%. The mean nasal index was comparatively higher in males than females. Comparing the difference in mean nasal index of two groups, Student's t test showed significantly ($P < 0.01$) different and higher (4.9%) nasal index of males as compared to females (76.47 ± 6.62% vs. 80.42 ± 9.43%, mean difference=3.96%, t=3.43, $P = 0.001$) (Table 3 and Fig. 12).

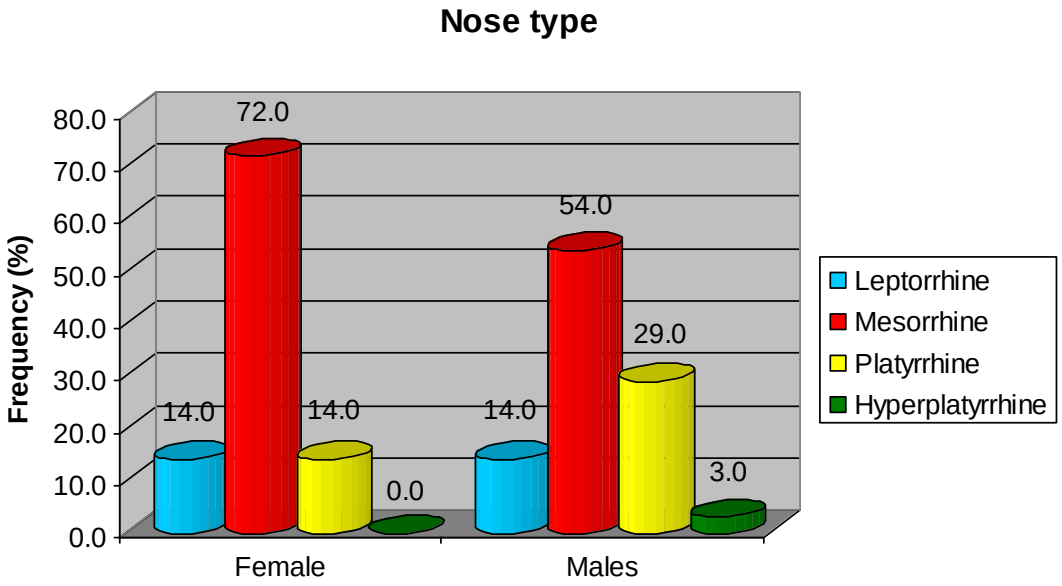
Table 4: Frequency distribution of nose type of two sex groups

Nasal type	**Females (n=100) (%)**	**Males (n=100) (%)**	**χ^2 value**	***P* value**
Leptorrhine	14 (14.0)	14 (14.0)	10.80	0.013
Mesorrhine	72 (72.0)	54 (54.0)		
Platyrrhine	14 (14.0)	29 (29.0)		
Hyperplatyrrhine	0 (0.0)	3 (3.0)		

The frequency distribution of nose type of two groups is summarised in number (n) and percentage (%) and compared by χ^2 test (χ^2 value).

The nose type of females and males is evaluated using nasal index and is summarised in Table 4 and also shown in Fig. 13. In females, the nose type "mesorrhine" was found to be the most common (72.0%) followed similarly by "leptorrhine" (14.0%) and "platyrrhine" (14.0%), and "hyperplatyrrhine" (0.0%) the least. In males, the nose type "mesorrhine" was also found to be the most common (54.0%) followed by "platyrrhine" (29.0%), "leptorrhine" (14.0%) and "hyperplatyrrhine" (3.0%) the least.

Comparing the frequency (%) distribution of nose type of two groups, χ^2 test showed significantly ($P < 0.05$) different nose type between females and males (χ^2=10.80, P = 0.013) (Table 4 and Fig. 13).



Graph 13. Frequency distribution of nose type of two sex groups.

The significant difference in nose type between two sex groups mainly attributed to 18.0% higher frequency of nose type “mesorrhine” in females than males or 15.0% higher frequency of nose type “platyrrhine” in males than females.

The study of measurements and proportions of human body is called anthropometry. Several uses of anthropometry have long been documented; ranging from epidemiology, medical anthropology, forensics and criminology, ergonomics, biometrics etc. Physical attractiveness can be correlated with anthropometric standards like facial and nasal parameters. Facial and Nasal anthropometry plays a pivotal role in victim identification in disaster scene (forensic odontology), smile and esthetic design (esthetic dentistry) and racial identification. Type of face and shape of the nose is a noticeable trait that differs amongst different populations depending on the race and environmental conditions. Measurements of nose and philtrum are a part of 'golden proportions' in smile design and therefore is important for orthodontists, prosthodontists, forensic odontologists and cleft lip surgeons**.**

Even though facial and nasal anthropometric studies were done in the past, changes in lifestyle, nutrition, and ethnic mixing of populations have lead to changes in the distribution of body dimensions and therefore require regular updating of anthropometric data. Sexual dimorphism was also an important component to study as it could aid in victim identification during disasters and design of gender specific logistics.

The Indian population is a diverse lot. We have Dravidian descent in the south, Aryan descent in the north, Mongoloid descent in the north- east etc. The invasions in the past by Mughals from Persia and later by the English, French and Portuguese, have resulted in inter- racial marriages which has led to a conglomerate social fabric.

In the wake of COVID-19 pandemic, where mask wearing has become a norm, there is a definite surge in manufacture and design of respirators and surgical masks. Nasal

and facial anthropometric parameters will aid in ergonomics while manufacturing these accessories in bulk to serve a certain population.

We therefore found a purpose to update baseline anthropometric data, by evaluating nasofacial anthropometric parameters among the Indian population in the city of Lucknow. The present study was thus conceptualized with the title "Anthropometric study of facial and nasal parameters among Lucknow population: A cross sectional study".

A total of **200** subjects with an age group of **18-35** years were selected, as age negligibly affects the facial parameters in subjects above 18 years of age. Random sampling was done. Healthy individuals with no visible disfigurement of face were included in the study after an informed consent. Subjects with disfigured face / trauma of the nose / congenital facial malformations as well as subjects with the history of having undergone cleft lip surgeries; reconstructive surgeries or plastic surgeries of the face were excluded from the study. Nasal, Facial and Philtrum parameters were recorded using vernier calipers with accuracy of 0.01 mm with the subject's head in the anatomical position.

Continuous data were summarised as Mean ± SD (standard deviation) whereas discrete (categorical) in number (n) and percentage (%). Continuous two independent groups were compared by independent Student's t test whereas categorical groups were compared by chi-square (χ^2) test. A two-tailed (α=2) $P < 0.05$ was considered statistically significant. Analysis were performed on SPSS software (Windows version 22.0).

Face is the first feature that one notices in a person. Facial features can define a person, his origins and descent. It also gives a unique identity to the individual.

Based on Banister's classification[57]of Facial Index, types of face can be classified as (All the measurement are in millimetres):

Hypereuryprosopic (very broad, short face): X - 79.9

Euryprosopic (broad, short face): 80 – 84.9

Mesoprosopic (average face, round): 85 – 89.9

Leptoprosopic (tall, narrow face): 90 – 94.9

Hyperleptoprosopic (very tall, narrow face): 95 – X

On comparing mean facial length in both genders we found it was significantly higher in males; the mean facial width showed similar results too. The mean facial index though failed to show any significant difference between genders. Males usually exhibit a higher rate of growth and to a longer period of time; perhaps this differential growth rate explains the sexual dimorphism in all parameters.

Based on facial index the present study revealed female face type to be predominantly "hyperleptoprosopic" (43.0%) followed by "leptoprosopic" (24.0%), "mesoprosopic" (21.0%) and euryprosopic (12.0%). We found no "hypereuryprosopic" faces. Amongst males, the face type showed similar trend as of females with highest frequency of "hyperleptoprosopic" (40.0%) followed by "leptoprosopic" (36.0%), "mesoprosopic" (16.0%), euryprosopic (7.0%) and "hypereuryprosopic" (1.0%).

Mane et al[58] in their study of Indian population also recorded similar results where predominant face type in both genders was hyperleptoprosopic with oval shape.

Hyperleptoprosopic faces are long faces with more vertical than horizontal dimensions. Our study was done in Lucknow, a north indian city with predominantly Aryan descent. Also it is interesting to note that Lucknow has a strong signature of Mughal invasion in terms of food, culture and monuments as Nawabs of Awadh who ruled it had a Persian-Iranian descent. Probably we are therefore now studying a

population with inter-ethnic gene pool or a mixed gene pool. The above finding is supported by two studies from present day Iran by Jaberi KR et al[31]and Dodangreh et al[30]where the predominant face type is hyperleptoprosopic.

In several studies, the effects of facial dimensions and forms on respiratory resistance have been investigated. Accordingly, it has been suggested that long narrow faces (long face length and narrow face width) could result in increased turbulence and thus more resistance inside respirator masks.[59] Since we found hyperleptoprosopic face to be predominant in the present study, this population perhaps may need specially designed masks and respirators for effective use. Our study in the pandemic times could be used as a baseline data in ergonomic mass production of masks & respirators.

There are two episodes of relatively rapid growth / growth spurts for both general somatic and craniofacial growth. The mid-childhood spurt, tends to occur more frequently and approximately one year later for boys than girls. The more prominent adolescent growth spurt begins in females approximately two or more years ahead of males. The extra years of childhood growth prior to adolescence in males, as well as the slightly greater rates of adolescent growth and the slightly lengthier adolescent period, explains most of the sex differences in overall body size and craniofacial dimensions.[60]

TABLE 5:Facial anthropometric studies done in Indian population.

STUDIES (INDIAN)	STUDY POPULATION	FACIAL PARAMETERS
Shah S et al; 2012	Gujrat	Mesoprosopic in males Euryprosopic in females
Chhabra N et al; 2012	North Indians	Mesoprosopic in females Leptoprosopic in males
Prasanna et al; 2013	South & North Indians	Hyperleptoprosopic in both genders
Ashwani C et al; 2014	South & North Indians	Leptoprosopic in both genders
Kataria DS et al; 2015	North Indians	Mesoprosopic in both genders
Chettri MN et al; 2017	Sikkim manipal university	Hyperleptoprosopic females
Gupta S et al; 2019	Haryanvi	Mesoprosopic in both genders
PRESENT STUDY	**LUCKNOW POPULATION**	**HYPERLEPTOPROSOPIC**

The above data (Table 5) signifies regional variations in face types among Indians who cannot be grouped under one umbrella of facial type.

Chettri (2017)[46] conducted a study among students of Sikkim Manipal University where the population of Sikkim was divided into Nepali's, Bhutias, Lepchas and Sherpas; all of who had hyperleptoprosopic faces. This was similar to our study, but their study population included only females; whereas ours was both genders. Chettri's study is important, as there is a lot of inter-ethnic mixing between Indians living in the border areas of Uttar Pradesh and North Eastern states like Sikkim with Nepal. Lucknow, our area of study is the capital of Uttar Pradesh and therefore explains the similarity between our study and theirs.

Prasannaet al[56]**(**2013) and Ashwani C et al[61](2014) performed studies in north and south indians and found the face type to be hyperleptoprosopic (which is similar to our study) and leptoprosopic respectively.

Kataria DS et al[62](2015) performed studies among north Indians and found mesoprosopic face was predominant in both sexes. The difference in findings may be due to regional variations of sample populations.

TABLE6:Types of face among neighbouring countries.

OTHER STUDIES	STUDY POPULATION	FACIAL PARAMETERS
Jeremic D et al; 2013	Central Serbia	Leptoprosopic in both genders
Azizi M et al; 2014	Qazvin, Iran & DG Khan, Pakistan	Hyperleptoprosopic in both genders: Qazvin, Iran Leptoprosopic and Mesoprosopic in both gender: DG Khan, Pakistan
Yesmin T et al; 2014	Malays	Mesoprosopic in both genders
Wai et al; 2015	Malays, Chinese, Indians	Leptoprosopic for Malays and Indians Mesoprosopic in Chinese
Pandey N et al; 2015	Medical students of Kathmandu, Nepal	Mesoprosopic in both genders
Chandimal KM et al; 2015	Sigiriya, Srilanka	Leptoprosopic in both genders
Dodangreh M et al; 2018	Medical students, Tehran, Iran	Hyperleptoprosopic
Shrestha R et al; 2019	Kathmandu, Nepal	Leptoprosopic in both genders
Madadi S et al; 2019	Medical students, Iran	Mesoprosopic in males Euryprosopic in females
PRESENT STUDY	**LUCKNOW POPULATION**	**HYPERLEPTOPROSOPIC**

Several facial anthropometric studies were reported among Indians and neighbouring populations. The above studies were selected for comparison due to several reasons.

Nepal and India have an open border and over ages both the populations have intermingled socio-culturally. Present day Malaysia has large numbers of third to fourth generation of Indian immigrant population. Tamil Malays and Punjabi Malays form a predominant part of the Malaysian society. Sri Lanka, our southern neighbour, has predominantly Tamils and Singhalese; where the former lot is of Indian descent. Pakistan was earlier a part of India and therefore shares similar demographics. Modern day Iran is the area from where Mughals invaded India in the early 16th to the mid 18thcentury and hence shares strong cultural signature in cities like Lucknow, Hyderabad and Delhi. Therefore it is only natural to find similar findings in study done by Azizi M et al[63] and Dodangreh et al[30].

Azizi M et al (2014)[63] compared population of Qazvin province, Iran with those of Dera ghazi of Punjab province, Pakistan & found that Iranians had a hyperleptoprosopic face which was similar as the present study results from Lucknow. This reiterates our belief that population of Lucknow definitely represents the awadhi-nawabi heritage with a strong genetic signature. The other area of Pakistan that they studied shares a geographic proximity with the Indian state of Punjab; probably Indian studies from Punjab may show similar results; but we couldn't find any documented literature for the same.

The above data (table 6) signifies similarity of face types in places closer to India and variations in further areas.

Nose is one of the most prominent facial features which play a pivotal role in esthetics. Fronto-nasal process and maxillary process aid in the embryological development of naso-maxillary complex. The complicated development of this area of face leads to various abnormalities, which in turn increases the frequency of nasal corrective surgeries that gives drastic change in appearance. We assessed nasal height,

nasal length, nasal depth, nasal width, columella width, philtrum length and philtrum width.

Based on nasal index, types of nose (Wai MMet al[7] 2015 and Hegazy AA et al[23] 2014) can be classified as (All the measurement are in millimetres):

Hyperleptorrhine (excessively tall and narrow): ≤54.9

Leptorrhine (tall and narrow): 55.0–69.9

Mesorrhine (medium): 70.0–84.9

Platyrrhine (broad and flat): 85.0–99.9

Hyperplatyrrhine (excessively broad and flat):≥100

All nasal and philtrum parameters were higher in males than females and were statistically significant. As already discussed for facial parameters, sexual dimorphism in nasal parameters may be due to differential growth rates as females reach skeletal maturity at an earlier age. Fusion of bony sutures follows a progressive pattern and is delayed in males. Probably growth is controlled by hormones that result in dimorphic characteristics.

The midface undergoes a complex modeling pattern throughout childhood and adolescence where it increases most in height, next in depth, and least in width; with more vertical than antero-posterior growth potential. Perhaps the reason why we found nasal height greater as compared to nasal depth and nasal width (NH> ND>NW). In adolescents, sexual dimorphism increases throughout the midfacial complex, with differences of approximately 4 mm in maxillary length (ANS-PNS) which increases 5 to 7 mm during late adolescence in males. Adult males are larger than adult females due to the two extra years of childhood growth and more intense adolescent spurt that males have.[64]

In our study, the predominant nose type was mesorrhine in both genders (72% in females and 54% in males); but we also noticed 29% platyrrhine nose in males. Probably the increased nasal width was due to the increased growth rate in males.

Several studies have linked types of nose to evolutionary adaptation to climatic and environmental factors.

According to Negus[65], populations adapted to dry environments have large, protruding external noses, downwardly directed nostrils and narrower skeletal apertures inducing turbulence to nasal airflow increasing filtration and humidification of air within nasal passages while those with smaller, flatter anteriorly directed external nares; and shorter piriform apertures are better adapted to humid environments.

Thomson and Buxton[66]in their study concluded that 'a platyrrhine nasal index was associated with hot, moist climate, and a leptorrhine nasal index with a cold, dry climate'. Hall correlated nasal dimensions and oxygen consumption where size of the fleshy nose, supports the amount of air that needs to be processed where leptorrhine noses were common in cold dry climates. Males, who consume relatively more oxygen during exercise, would be expected to have relatively broader noses or a longer or more extended nasal tip than females in the same population.[33]As much of the energy required for breathing is expended in the nasal passages, a broader flatter nasal structure favours less turbulent airflow, which is physiologically provides lower nasal airway resistance. In platyrrhine nose, inspired air passes through more horizontally placed nostrils and are directed towards the inferior portion of the nasal chamber to condition very warm air.[67]

In our study we found mesorrhine noses in both males and females which can be correlated with the tropical climate in India.

Lucknow, where the study was done has 9 months of hot and humid climate along with 3 months of dry cold weather. We also believe that the poor air quality in the area which has been there since many decades cannot be discounted. To inhale more oxygen, one has to spend more energy and such habitual changes might have a role to play in shaping the nose. Perhaps that is the reason why we found broad noses inspite of finding vertically slender noses. In addition, the second common nose type we recorded was platyrrhine in males. May be we are evolving towards a broader nose to ensure more oxygen availability from polluted environments.

Mehta et al[68] in their study on Indian nose found mild differences in nasal parameters based on regions. Nasal height was more in North Indians while nasal width was more among south Indians. They concluded that Indians on an average had a mesorrhine nose compared to leptorrhine nose in Caucasians and Orientals and platyrrhine nose in Africans. This was similar to the present study where we found a predominant mesorrhine nose type.

One of the pioneer anthropometric studies carried out in India was by Sir Risley who recorded that Aryo-Dravidians residing in Uttar Pradesh and some parts of Bihar have medium sized noses and Indo-Aryans residing in Punjab and Rajasthan have long and narrow noses.[69]We believe since the time of Sir Risley's study, years have passed where there has been inter-ethnic marriages and therefore we may still have mesorrhine noses but with mean differences in nasal height and width.

TABLE 7: Types of nose among Indians.

STUDIES (INDIAN)	STUDY POPULATION	NASAL PARAMETERS
Chhabra N et al; 2012	North Indians	Mesorrhine
Chowdhary A et al; 2012	Jats, Sindhi of Rajasthan	Leptorrhine Jats Mesorrhine Sindhis
Sharma SK et al; 2014	Gwalior	Mesorrhine
Patil GB et al; 2014	South Indians	Mesorrhine Males Leptorrhine Females
Asharani SK et al; 2015	North and South Indians	Mesorrhine in both genders
Ray SK et al; 2016	Western Uttar Pradesh	Mesorrhine in both genders
Mehta et al; 2017	North; Central; West; South; and Himalayan region	North Indians-Leptorrhine South Indians-Broadest nose Himalayan-Shortest nose Indians on an average had a Mesorrhine type compared to leptorrhine nose in Caucasians and Orientals and platyrrhine nose in Africans
B Sadhvi et al; 2018	South Indians	Mesorrhine males
Jabeen N et al; 2019	J and K	Leptorrhine male and female
Andhare P et al; 2020	Maharashtra	Mesorrhine male and female
Singla M et al; 2020	Jaunsaris, Dehradun	Leptorrhine
Rohith MM et al; 2020	Gujrat	Mesorrhine male and female
PRESENT STUDY	**LUCKNOW POPULATION**	**MESORRHINE**

With few exceptions, majorly all Indian studies have reported a mesorrhine nose type; which is in concordance to the present study. The difference in findings reported by Singla M[18] may be due to the fact that Jaunsari tribe belongs to the hills and are habituated to cold weather. Chowdhary A et al[28] reported variations as they studied Jats, a genetically tall sect who are believed to be "true Aryans who are high nosed and tall headed"[70]

Nusrat et al[71]reported leptorrhine nose among Kashmiris which may be related to cold weather they live in or due to the widely believed fact that Kashmiris are descendants of the ten lost tribes of Israel. The above studies (table 7) signifies that Indians have mesorrhine noses predominantly which may be explained to a greater extent to the hot and humid weather.

TABLE 8:Types of Nose among neighboring countries.

OTHER STUDIES	**STUDY POPULATION**	**NASAL PARAMETERS**
Chandimal KM et al. 2014	Sigiriya, Srilanka	Mesorrhine in both genders
Tahmasebi F et al. 2015	Iran	Leptorrhine in both genders
Wai et al. 2015	Malays, Chinese, Indians	Mesorrhine nose
Yadav SK et al. 2018	Napalese population	Mesorrhine nose
Shrestha R et al. 2019	Kathmandu, Nepal	Mesorrhine in both genders
Dhulqarnain AO et al. 2020	Northwestern Nigeria & Northern Iranian populations	Mesorrhine: Nigeria Leptorrhine: Northern Iran
PRESENT STUDY	**LUCKNOW POPULATION**	**MESORRHINE**

The above studies (table 8) in the neighbouring populations also have reported a mesorrhine nose type predominantly, which may reiterate the fact that nose type is dependent on weather and environment to a greater extent.

Philtrum parameters are important because it is a vital part of the upper lip. The upper lip is characterized by a symmetrical pair of paramedian vertical philtrum ridges bordering the central depression known as the philtrum, directly below the nasal septum. Variations in the anatomy of the lips and philtrum can indicate developmental abnormalities. Smoothening or flattening of the philtrum and a thin upper lip are seen in fetal alcohol syndrome. Autism spectrum disorders may have a broader philtrum.[72] Few studies are documented on philtrum parameters and this is one of the first studies from India. We found sexual dimorphism in philtrum parameters with males having a wider and longer philtrum as compared to females.

The present study was conducted to determine the sexual dimorphism and ethnic variations among Lucknow population via anthropometric measurements. Many facial and nasal anthropometric studies are documented in the literature but because of environmental changes, ethnic mixing of population etc., regular updating of anthropometric data is required.

Following conclusions can be drawn from the aforesaid study.

- ✓ Facial parameters in Lucknow population showed predominantly hyperleptoprosopic (female face type 43.0% and males face type 40.0%).
- ✓ There was a definite sexual dimorphism in facial & nasal parameters with measurements increased in males than in females.
- ✓ Facial parameters showed regional variation within India with different facial types seen in different regions; on comparing with neighbouring countries significant variation can be noted.
- ✓ Nasal parameters in Lucknow population is predominantly mesorrhine (72% in females, 54% in males) though this type is more common in females than in males.
- ✓ Nasal parameters showed predominantly mesorrhine type within India as well as in neighbouring countries.
- ✓ Sexual dimorphism in philtrum parameters with males having a wider and longer philtrum as compared to females.
- ✓ The findings of vertical face and broad nose in our study sample suggests that probably facial type is majorly dependent on genetic descent and nasal type on climatic / environmental factors.

To conclude, sexual dimorphism can be used in forensics and in ergonomic development of surgical and facial accessories. Taking into account the huge Indian immigrant population in North American and European continents, these results with regional findings will provide baseline data to researchers worldwide.

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Annexure – I

BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES (FACULTY OF BBD UNIVERSITY), LUCKNOW

INSTITUTIONAL RESEARCH COMMITTEE APPROVAL

The project titled **"Anthropometric Study of Nasal and Facial Parameters Among Lucknow Population: A Cross Sectional Study."** submitted by **Dr Vandana Prasad** Post graduate student from the **Department of Oral Pathology & Microbiology** as part of MDS Curriculum for the academic year 2018-2021 with the accompanying proforma was reviewed by the Institutional Research Committee present on **04th January, 2021** at BBDCODS.

The Committee has granted approval on the scientific content of the project. The proposal may now be reviewed by the Institutional Ethics Committee for granting ethical approval.

Prof. Vandana A Pant
Co-Chairperson

Prof. B. Rajkumar
Chairperson

Annexure – II

Babu Banarasi Das University
Babu Banarasi Das College of Dental Sciences,
BBD City, Faizabad Road, Lucknow – 226028 (INDIA)

Dr. Lakshmi Bala
Professor and Head Biochemistry and
Member-Secretary, Institutional Ethics Committee

Communication of the Decision of the VII[th] Institutional Ethics Sub-Committee

IEC Code: 05 (Revised) **BBDCODS/01/2021**

Title of the Project: Anthropometric Study of Nasal and Facial Parameters among Lucknow Population: A Cross Sectional Study.

Principal Investigator: Dr. Vandana Prasad **Department:** Oral Pathology & Microbiology

Name and Address of the Institution: BBD College of Dental Sciences Lucknow.

Type of Submission: Revised, MDS Project Protocol

Dear Dr. Vandana Prasad,

The Institutional Ethics Sub-Committee meeting comprising following four members was held on 07[th] January 2021.

1.	Dr. Lakshmi Bala Member Secretary	Prof. and Head, Department of Biochemistry, BBDCODS, Lucknow
2.	Dr. Amrit Tandan Member	Prof. & Head, Department of Prosthodontics and Crown & Bridge, BBDCODS, Lucknow
3.	Dr. Sumalatha M.N. Member	Reader, Department of Oral Medicine & Radiology, BBDCODS, Lucknow
4.	Dr. Akanksha Bhatt Member	Reader, Department of Conservative Dentistry & Endodontics, BBDCODS, Lucknow

The committee reviewed and discussed your submitted documents of the current MDS Project Protocol in the meeting.
The comments were communicated to PI thereafter it was revised.

Decisions: The committee approved the above protocol from ethics point of view.

Forwarded by:

Lakshmi Bala 07/01/21

(Dr. Lakshmi Bala)
Member-Secretary
IEC

Member-Secretary
Institutional Ethic Committee
BBD College of Dental Sciences
BBD University
Faizabad Road, Lucknow-226028

(Dr. B. Rajkumar)
Principal
BBDCODS

PRINCIPAL
Babu Banarasi Das College of Dental Sciences
(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow-226028

Annexure – III

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

Consent Form (English)

Title of the Study ……..

Study Number……..
Subject's Full Name…….
Date of Birth/Age ……
Address of the Subject……..
Phone no. and e-mail address……
Qualification ……
Occupation: Student / Self Employed / Service / Housewife/ Other (Please tick as appropriate)
Annual income of the Subject……
Name and of the nominees(s) and his relation to the subject…… (For the purpose of compensation in case of trial related death).

1. I confirm that I have read and understood the Participant Information Document dated ……..for the above study and have had the opportunity to ask questions. **OR** I have been explained the nature of the study by the Investigator and had the opportunity to ask questions.
2. I understand that my participation in the study is voluntary and given with free will without any duress and that I am free to withdraw at any time, without giving any reason and without my medical care or legal rights being affected.
3. I understand that the sponsor of the project, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. However, I understand that my Identity will not be revealed in any information released to third parties or published.
4. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).
5. I permit the use of stored sample (tooth/tissue/blood) for future research. **Yes [ ]** **No [ ]**

6. I agree to participate in the above study. I have been explained about the complications and side effects, if any, and have fully understood them. I have also read and understood the participant/volunteer's Information document given to me.

Representative:……..
Signatory's Name……. Date …….
Signature of the Investigator…… Date……..
Study Investigator's Name..... Date……..
Signature of the witness…… Date……..
Name of the witness……
Received a signed copy of the PID and duly filled consent form
Signature/thumb impression of the subject or legally Date……..

Acceptable representative

Annexure – IV

Babu Banarasi Das College of Dental Sciences
(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

सहमति पत्र

अध्ययन शीर्षक.....
अध्ययन संख्या.....
प्रतिभागी के पूर्ण नाम.....
जन्म तिथि / आयु.....
प्रतिभागी का पता .....
फोन नं. और ई-मेल पता .....
योग्यता .....
व्यवसाय: छात्र / स्व कार्यरत / सेवा / ग्रहिणी .....
अन्य (उचित रुप मे टिक करें) .....
प्रतिभागी की वार्षिक आय .....
प्रत्याशीयो के नाम और प्रतिभागी से संबंध...(परीक्षण से संबंधित मौत के मामले मे मुआवजे के प्रयोजन के लिए)

1. मेरी पुष्टि है कि मैने अध्ययन हेतु सुचना पत्र दिनांक ..... को पढ व समझ लिया तथा मुझे प्रश्न पुछने या मुझे अध्ययन अन्वेषक ने सभी तथ्यों को समझा दिया है तथा मुझे प्रश्न पुछने के समान अवसर प्रदान किए गये।

2. मैंने यहॉ समझ लिया कि अध्ययन में मेरी भागीदारी पूर्णतः स्वैच्छिक है और किसी भी दबाव के बिना स्वतंत्र इच्छा के साथ दिया है किसी भी समय किसी भी कारण के बिना , मेरे इलाज या कानूनी अधिकारो को प्रभावित किए बिना , अध्ययन में भाग न लेने के लिए स्वतंत्र हुँ ।

3. मैंने यह समझ लिया है कि अध्ययन के प्रायोजक , प्रायोजक की तरफ से काम करने वाले लोग, आचार समिति और नियामक अधिकारियों को मेरे स्वास्थ्य रिकार्ड को वर्तमान अध्ययन या आगे के अध्ययन के सन्दर्भ देखने के लिए मेरी अनुमति की जरूरत नही है, चाहे मैने इस अध्ययन से नाम वापस ले लिया है। हॉलाकि मै यह समझता हुँ कि मेरी पहचान को किसी भी तीसरे पक्ष या प्रकाशित माध्यम में नही दी जायेगी।

4. मै इससे सहमत हूँ कि कोई भी डेटा या परिणाम जो इस अध्ययन से प्राप्त होता है उसका वैज्ञानिक उद्देश्य (ओं) के उपयोग के लिए मेरी तरफ से कोई प्रतिबंध नही है।
5. भविष्य के अनुसंधान के लिए भंडारित नमूना (ऊतक/रक्त) पर अध्ययन के लिए अपनी सहमति देता हुँ।

हॉ [ ] नही [ ] अनउपयुक्त [ ]

ANNEXURE- V

Observations

Group A: Females

Subjects	A. Demographic			B. Facial parameters			C. Nasal parameters							
	Age (yrs)	Height (cm)	Weight (kg)	Facial length (mm)	Facial width (mm)	Facial index (%)	Nasal height (mm)	Nasal length (mm)	Nasal depth (mm)	Nasal width (mm)	Columella width (mm)	Philtrum length (mm)	Philtrum width (mm)	Nasal Index (%)
1	27	152.4	56	93	104.4	89.1	44.4	33.8	12.9	32.7	5.6	10.9	9.9	73.6
2	30	157.5	63	94.3	95.2	99.1	44.7	36.3	11.5	39.2	9.2	10.8	12.8	87.7
3	26	152.4	57	91.7	91.6	100.1	41.6	37.6	11.1	36.6	7.6	8	8.2	88.0
4	34	157.5	55	91.9	111	82.8	39.3	36.6	18.9	33.4	5.5	16.2	9.1	85.0
5	29	165.1	60	105.7	105.4	100.3	47.7	44.7	17.1	31.4	8.4	12.5	8.6	65.8
6	26	160.0	61	96.6	113.7	85.0	42.7	37.2	15	36.5	6.8	11.8	11.2	85.5
7	28	167.6	58	82.2	100.2	82.0	45.2	40.1	13.4	36.1	8.5	7.9	10.4	79.9

8	27	160.0	54	91.7	105.4	87.0	41.5	40.3	11.6	31	6.4	10.7	11.3	74.7
9	28	162.6	66	92.8	89.31	103.9	36.4	28	8.8	27.9	4.5	6.9	6.3	76.6
10	29	162.6	60	89.4	102.2	87.5	36.7	32.4	7.8	30	4.4	6.5	6.2	81.7
11	27	170.2	75	95.2	97.2	97.9	36.9	31.5	7.6	32.6	5.6	8	8.5	88.3
12	28	162.6	90	94.4	105.8	89.2	38.3	29.2	3.4	28.2	5	7.7	7.5	73.6
13	27	162.6	50	81.9	91.8	89.2	44.4	41.4	11.8	32.1	6	11.5	7	72.3
14	29	160.0	62	93.9	103.9	90.4	35.4	30	4.2	24.8	5.5	6.6	6.4	70.1
15	25	160.0	67	94.3	107.4	87.8	37.3	31.3	5.6	27	6.5	7.2	7.7	72.4
16	24	152.4	52	86.2	89.3	96.5	33.1	27.1	7.9	26.6	6.4	6.7	6.5	80.4
17	28	172.7	96	90	102.6	87.7	38	33.1	5.5	26.9	5.5	6.1	6.8	70.8
18	30	160.0	53	88.4	101.9	86.8	36.7	31.8	10	28.9	3.2	6	6.1	78.7
19	28	152.4	49	95.5	115	83.0	37.4	33.2	7.9	28.9	2.6	4	4.4	77.3
20	27	162.6	44	91.9	102.6	89.6	42.3	34.7	12.4	32.5	9.2	12.1	11	76.8
21	24	162.6	58	88.5	99.8	88.7	42.3	36.4	15.6	31.5	8.3	12.5	10.8	74.5

22	25	160.0	60	94.4	105.4	89.6	42.7	33.9	16.5	36	6.3	9.3	9.8	84.3
23	26	160.0	50	101.8	108.5	93.8	46.4	36.9	14.8	34.1	5.9	9.6	9.2	73.5
24	25	160.0	57	85	100.5	84.6	43.6	39	14.1	36.6	5.6	12.6	9.9	83.9
25	29	165.1	50	96	107.7	89.1	50.7	42.6	14.4	38.8	7.6	8	8.6	76.5
26	26	162.6	52	81.7	96.2	84.9	45.3	36.2	15.6	29.8	6.1	7	8.3	65.8
27	27	165.1	63	89	99.9	89.1	44.2	39.3	12.8	33.4	9.7	9.1	9.3	75.6
28	26	165.1	55	106.6	107.2	99.4	42.3	37.8	13.1	31.9	8.5	11.2	9.5	75.4
29	29	167.6	65	92.6	108.9	85.0	44.7	39.2	19.5	35.5	7.8	11.9	9.8	79.4
30	26	157.5	58	94.3	105	89.8	47.9	45.4	14	34.8	7.1	12.7	12.8	72.7
31	28	157.5	57	86.5	98.3	88.0	44.2	39.6	8.1	31.6	7.7	10.8	10.7	71.5
32	24	160.0	55	82.1	98	83.8	44.1	41.5	14	33.9	4.6	8.6	8.1	76.9
33	26	152.4	57	91.7	100.6	91.2	41.6	37.6	11.1	36.6	7.6	8	8.2	88.0
34	26	152.4	60	99.3	101	98.3	42.4	38.6	11.2	35.7	6.5	10.7	10.5	84.2
35	28	154.9	54	82.8	96.7	85.6	40.8	40.3	11.7	31.9	6	8.1	7.9	78.2

36	21	165.1	63	81	92.3	87.8	26.1	30.7	10	19.6	5.3	10	10.6	75.1
37	21	170.2	70	87.7	109.1	80.4	34.9	27.5	7.7	25.1	5.9	11.8	9.4	71.9
38	23	157.5	43	88.2	99	89.1	39.1	37.5	12.2	29.7	7.5	5.3	9.6	76.0
39	24	160.0	58	91.8	102.1	89.9	41.5	34.9	15.8	30	6.8	10.5	9.5	72.3
40	22	152.4	40	82.8	94.6	87.5	43.3	42	15.5	32	7.1	9.1	10.3	73.9
41	23	162.6	48	98.8	100	98.8	45.9	38.2	19.2	35.6	7.8	9.2	8.6	77.6
42	22	165.1	67	94.4	105.4	89.6	40	35.5	18	29.2	8.1	9.8	9.2	73.0
43	22	160.0	59	90.5	100.6	90.0	46	42.9	17.3	31.6	7.8	8.5	9.6	68.7
44	21	157.5	48	87	98.7	88.1	42.1	34.9	12.8	32.9	5.2	9.2	8.6	78.1
45	27	152.4	56	99.1	104.4	94.9	44.4	33.8	12.9	32.7	5.6	10.9	9.9	73.6
46	26	149.9	45	91.1	110.9	82.1	45.4	36.8	11.5	36.1	6.4	11.5	10.7	79.5
47	25	162.6	75	107.6	114.4	94.1	45.3	39.4	16.7	35.6	6	10.1	9	78.6
48	28	170.2	65	92.2	102.7	89.8	47.8	41.3	13.8	35.5	7.6	12.6	11.5	74.3
49	26	177.8	81	86.1	97.1	88.7	51.5	43.9	16.5	40.3	7.7	11	9.7	78.3

50	27	162.6	50	83.3	91.8	90.7	44.4	41.4	11.8	32.1	6	11.5	7	72.3
51	25	160.0	57	95.6	100.5	95.1	43.6	39	14.1	36.6	5.6	12.6	9.9	83.9
52	27	152.4	54	99.4	96.7	102.8	46.8	40.3	11.7	31.9	6	8.1	7.9	68.2
53	27	152.4	45	104.2	102.6	101.6	42.4	36.8	11.5	36.1	6.4	11.5	10.7	85.1
54	29	162.6	84	81	98.3	82.4	42.6	35.8	14.8	39.1	5	11.5	8.4	91.8
55	28	167.6	56	82.1	99.8	82.3	46.5	42.4	18.1	34	6.5	12.6	10.8	73.1
56	27	160.0	95	92	105	87.6	43.5	35.4	14.8	36.1	5.1	10.3	11.1	83.0
57	29	162.6	84	87.7	98.3	89.2	42.6	35.8	14.8	31.1	5	11.5	8.4	73.0
58	29	162.6	57	107.8	105.4	102.3	48	42.6	18.6	32	6.5	10.7	9.3	66.7
59	27	170.2	65	105.9	111.3	95.1	44.8	37.8	14.9	39.8	5.7	11	9.9	88.8
60	33	170.2	68	114.2	115.1	99.2	49.6	41	14.1	37.5	6.5	9.8	10	75.6
61	30	157.5	70	94.3	95.2	99.1	44.7	36.3	11.5	39.2	9.2	10.8	12.8	87.7
62	35	157.5	55	87.3	101.5	86.0	39.3	36.6	18.9	33.4	5.5	16.2	9.1	85.0
63	25	165.1	60	105.7	105.4	100.3	47.7	44.7	17.1	31.4	8.4	12.5	8.6	65.8

64	26	160.0	61	111.1	113.7	97.7	42.7	37.2	15	36.5	6.8	11.8	11.2	85.5
65	28	167.6	58	101.1	100.2	100.9	45.2	42.1	13.4	36.1	8.5	7.9	10.4	79.9
66	27	160.0	54	91.7	105.4	87.0	41.5	40.3	11.6	36.8	6.4	10.7	11.3	88.7
67	28	162.6	66	92.8	90.3	102.8	36.4	28	8.8	27.9	3.5	1.9	2.3	76.6
68	28	167.6	56	88	99.8	88.2	46.5	42.4	18.1	34	6.5	12.6	10.8	73.1
69	29	162.6	60	89.4	102.2	87.5	36.7	32.4	7.8	30	0.4	5	3.2	81.7
70	27	170.2	75	95.2	97.2	97.9	36.9	31.5	7.6	32.6	2.3	4	3.5	88.3
71	28	162.6	90	94.4	105.8	89.2	38.3	29.2	3.4	28.2	0.4	1.7	3.5	73.6
72	29	160.0	62	93.9	94.3	99.6	35.4	30	4.2	24.8	0.4	5.2	5.6	70.1
73	28	160.0	67	94.3	93.5	100.9	37.3	31.3	5.6	25.3	1.5	5.2	2.7	67.8
74	29	152.4	52	86.2	89.3	96.5	33.1	27.1	7.9	26.6	1.4	6.7	3.5	80.4
75	28	172.7	96	103.2	102.6	100.6	40.1	33.1	5.5	26.9	2.5	3.1	2.8	67.1
76	26	175.3	65	98.6	97.4	101.2	46.6	40.9	6.2	33.3	3.6	1.7	2.3	71.5
77	26	170.2	75	109.9	107.6	102.1	40.2	30.6	8.1	26.4	1.8	8	7.9	65.7

78	29	149.9	82	101.6	115	88.3	41.3	35.5	9.8	29.1	6	4.6	4	70.5
79	27	160.0	95	92	105	87.6	43.5	35.4	14.8	36.1	5.1	10.3	11.1	83.0
80	30	152.4	49	95.5	94.4	101.2	37.4	33.2	9	28.9	1.6	4	4.4	77.3
81	27	162.6	44	96.9	102.6	94.4	42.3	34.7	12.4	32.5	9.2	12.1	11	76.8
82	25	160.0	57	106.6	105.4	101.1	46.4	41.8	12.4	28	5.8	11.6	8.9	60.3
83	25	177.8	70	115.6	116.3	99.4	44.1	37.9	12	36.5	8.7	10.6	12.3	82.8
84	27	177.8	72	107.6	112.2	95.9	47.9	43.3	15.7	39.6	8.9	8.7	9.8	82.7
85	26	167.6	62	92.6	109.7	84.4	53.4	45.8	12.9	34.5	8.3	9	9.9	64.6
86	24	162.6	58	108.7	105.6	102.9	42.3	36.4	15.6	31.5	8.3	15.5	10.8	74.5
87	25	160.0	60	108.4	105.4	102.8	42.7	33.9	16.5	36	6.3	9.3	9.8	84.3
88	26	160.0	50	101.8	108.5	93.8	46.4	36.9	14.8	34.1	5.9	9.6	9.2	73.5
89	29	165.1	50	108.3	107.7	100.6	50.7	42.6	14.4	38.8	7.6	8	8.6	76.5
90	29	157.5	57	91.9	105.4	87.2	48	42.6	18.6	32	6.5	10.7	9.3	66.7
91	26	162.6	52	98.5	96.2	102.4	45.5	36.2	15.6	29.8	6.1	7	8.3	65.5

92	27	165.1	63	85.5	100.5	85.1	44.2	39.3	6.8	33.4	9.7	9.1	9.3	75.6
93	27	180.3	67	104.6	97.2	107.6	46.5	41.6	16.8	34.9	5.7	9.1	9.5	75.1
94	26	167.6	75	84	105.6	79.5	49.6	41.2	16	35.3	8.9	15.1	12.3	71.2
95	26	165.1	55	106.6	107.2	99.4	42.3	37.8	13.1	31.9	8.5	11.2	9.5	75.4
96	29	167.6	65	83.8	95.7	87.6	44.7	39.2	19.5	35.5	7.8	11.9	9.8	79.4
97	26	157.5	58	84.6	105	80.6	47.9	45.4	14	34.8	7.1	12.7	12.8	72.7
98	28	157.5	57	93.9	116.7	80.5	44.2	39.6	10	31.6	7.7	10.8	10.7	71.5
99	26	172.7	70	99.3	119	83.4	43.3	40.2	16.2	30.1	7.1	8.1	8.6	69.5
100	24	161.5	55	94	98	95.9	44.1	41.5	14	33.9	4.8	8.6	8.1	76.9

Group B: Males

Subjects	A. Demographic			B. Facial parameters			C. Nasal parameters							
	Age (yrs)	Height (cm)	Weight (kg)	Facial length (mm)	Facial width (mm)	Facial index (%)	Nasal height (mm)	Nasal length (mm)	Nasal depth (mm)	Nasal width (mm)	Columella width (mm)	Philtrum length (mm)	Philtrum width (mm)	Nasal Index (%)
1	31	172.7	78	89.6	100	89.6	51	49	15	40	8	12	11	78.4
2	26	157.5	60	110	125	88.0	49.9	47	19	44	8	7.1	7	88.2
3	18	152.4	65	104	119	87.4	44.9	42.9	20	39	8.9	9.9	10	86.9
4	27	162.6	63	101	109	92.7	53.1	49.1	18.7	41	7.7	11	10.9	77.2
5	21	167.6	64	113.1	127.3	88.8	51	49	14	45	8.7	11.1	9.9	88.2
6	28	157.5	56	108	114	94.7	52	45.2	11.8	47	10	12.5	12.7	90.4
7	28	160.0	58	101.9	114	89.4	49	46.9	13	39.9	9.7	10.6	10.5	81.4
8	29	162.6	66	99.9	113	88.4	47.2	45.2	11.1	38.7	8.8	10.6	11.1	82.0
9	25	162.6	75	107.6	114.8	93.7	45.3	39.4	16.7	35.6	6	10.1	9.1	78.6

10	28	177.8	65	106.5	128.7	82.8	47.8	41.3	13.8	35.6	7.8	12.6	11.5	74.5
11	26	180.3	81	109.9	125.9	87.3	51.5	43.9	16.5	40.3	7.7	11	9.7	78.3
12	20	182.9	76	89.9	99.9	90.0	45	43	14.8	38	8.4	14	15	84.4
13	27	170.2	65	94.5	111.3	84.9	44.8	37.8	14.9	39.8	5.7	11	9.9	88.8
14	33	170.2	68	113.2	125.3	90.3	49.6	41	14.1	37.5	6.5	9.8	10	75.6
15	26	172.7	75	112.2	127.6	87.9	40.2	30.8	8.1	26.4	6.8	8	7.9	65.7
16	26	165.1	65	100.6	127.4	79.0	46.6	40.9	6.2	33.3	3.6	5.7	5.3	71.5
17	30	167.6	66	98.4	111.9	87.9	46.7	41.8	11	38.9	5	6	6.1	83.3
18	25	165.1	63	113.8	128	88.9	46.4	42.8	12.4	38	5.8	11.6	11.9	81.9
19	25	172.7	70	105	118.3	88.8	44.1	37.9	12	36.5	8.7	10.6	12.3	82.8
20	27	177.8	72	104.6	119.1	87.8	47.9	43.3	15.7	39.6	8.9	9.7	9.8	82.7
21	26	167.6	62	96.8	109.7	88.2	49.2	45.8	12.9	34.5	8.3	9	9.9	70.1
22	27	180.3	67	103.4	117.2	88.2	46.5	41.6	16.8	34.9	5.7	9.1	9.5	75.1
23	26	182.9	80	100	112	89.3	55	51	16	48	9	16	15	87.3

24	26	167.6	75	116.5	105.6	110.3	59.6	41.2	16	39.9	8.9	15.1	12.3	66.9
25	26	172.7	70	96.7	109.6	88.2	43.3	40.2	16.2	30.1	7.1	8.9	8.6	69.5
26	25	167.6	69	108.7	121	89.8	46.9	36.8	15	36.4	6.4	13.3	13.4	77.6
27	20	162.6	74	106.1	115.2	92.1	46.1	38.8	16.3	30.6	8.5	9	10.7	66.4
28	23	157.5	57	95.4	109.2	87.4	51.3	46.7	13.6	36.5	7.8	9.6	10.8	71.2
29	24	165.1	67	101.9	113.9	89.5	49.1	37.6	15.8	31	6.9	12.1	9.7	63.1
30	22	157.5	50	103.7	119.2	87.0	48.2	42.3	19.8	37.7	4.9	9.6	9.5	78.2
31	28	165.1	65	100.8	119.9	84.1	44.4	38.6	15.4	34.6	7.9	13.8	10.3	77.9
32	25	177.8	75	104.5	118.9	87.9	45.7	42.9	16.7	33.3	9.4	13.3	14.2	72.9
33	26	170.2	80	98.7	117.3	84.1	50.1	43.1	16.9	41.7	10	11.1	11.3	83.2
34	29	165.1	65	110	122	90.2	49	44	14	45	8	10	10.3	91.8
35	27	162.6	78	100.7	115.7	87.0	51.3	50	16.3	40.8	9	10.9	10.7	79.5
36	23	165.1	65	95.9	110.9	86.5	49.9	45.9	15.9	39	8.9	9.1	9	78.2
37	25	172.7	68	105.5	118	89.4	45.4	40.1	19.2	36.7	7.1	12.5	13	80.8

38	31	162.6	64	106	112.6	94.1	44.8	41.1	21	40	6.3	9.6	11.8	89.3
39	21	162.6	62	111.9	125	89.5	49.3	47.5	17.8	35.7	5.7	10.5	10.6	72.4
40	22	167.6	68	103.5	116	89.2	46.1	36.5	18	34.2	6.4	11	10	74.2
41	27	180.3	86	107.2	110	97.5	46.7	43.8	22.4	31	7.8	10.1	10.5	66.4
42	24	165.1	59	101.1	114	88.7	41.5	45.3	19	34.2	6.4	11	10	82.4
43	27	177.8	67	99	111	89.2	49.1	45.4	16.2	35.8	7.7	10	10.2	72.9
44	24	167.6	58	102.2	116	88.1	46.7	45.3	18.2	40	6.7	8.9	9	85.7
45	28	170.2	70	98	119.2	82.2	53	50	19	44	7.9	9.9	9.5	83.0
46	25	162.6	75	107.6	114.4	94.1	45.3	39.4	16.7	35.6	6	10.1	9	78.6
47	28	177.8	65	105.9	102.7	103.1	47.8	41.3	13.8	35.5	7.6	12.6	11.5	74.3
48	26	180.3	81	102.9	97.1	106.0	51.5	43.9	16.5	40.3	7.7	11	9.7	78.3
49	32	160.0	70	106.4	118.9	89.5	48.2	44.7	21	40	10.9	13	13.6	83.0
50	28	160.0	60	103.5	116	89.2	47.2	44.5	18.4	40.5	9	13.4	14	85.8
51	33	167.6	75	92.8	112.2	82.7	50.6	49.9	15.7	37.4	10.5	12.1	12.4	73.9

52	35	167.6	76	98	118.8	82.5	47.8	43.9	23.3	33.7	9.5	14	13.9	70.5
53	22	167.6	58	97.8	115.4	84.7	49.7	44.9	17.2	42.4	11.2	11	11.5	85.3
54	24	170.2	67	103.1	105.7	97.5	50	47.3	20	44.9	10	12	12.1	89.8
55	35	172.7	75	108.8	117	93.0	51.5	43	19.6	49.8	9.6	15.2	15.5	96.7
56	30	175.3	75	99.7	116	85.9	54	51	18	47	7.5	9.7	9.9	87.0
57	26	177.8	75	113.8	105.2	108.2	40.7	38.5	19.5	36.7	9.8	13	13.3	90.2
58	18	165.1	56	92.9	104	89.3	51.4	45.2	13.4	40.9	7.8	8.4	9.3	79.6
59	35	198.1	60	105.8	102.9	102.8	55.7	48.7	11	42.2	9.9	10	10.1	75.8
60	21	165.1	75	98.9	115.8	85.4	46.3	42.8	19	37.7	10	11.2	11.5	81.4
61	35	167.6	55	113.1	101.5	111.4	39.3	36.6	18.9	33.4	5.5	16.2	9.1	85.0
62	30	172.7	65	97.9	102.1	95.9	48.1	43.7	18.6	45.5	8.6	10.3	10.4	94.6
63	23	172.7	64	90.2	116.9	77.2	47.6	36.8	14.9	40.5	9.8	11.5	11.4	85.1
64	26	167.6	65	105.7	115	91.9	48.2	45.3	23.9	43.9	11	16	12.3	91.1
65	27	157.5	63	117.2	118.4	99.0	46.1	43.4	22.1	39	9.8	13.5	12	84.6

66	28	162.6	66	92.8	90.3	102.8	36.4	28	8.8	27.9	3.5	1.9	2.3	76.6
67	21	167.6	69	102	115	88.7	49	51.8	20	43	8.1	8.8	8.6	87.8
68	23	172.7	83	114	122.3	93.2	46.5	44.3	17.2	33.7	9.6	13.8	9.8	72.5
69	27	170.2	75	95.2	97.2	97.9	36.9	31.5	7.6	32.6	4.3	6.6	6.3	88.3
70	30	170.2	78	119.5	121.9	98.0	46.5	41.4	14.8	51.7	11	11.9	11.2	111.2
71	26	188.0	67	110.6	114.9	96.3	54.4	48.2	15.5	43.1	13	13.7	13.9	79.2
72	28	167.6	66	106.5	112.2	94.9	54.4	40.6	14.7	36.7	9.8	13.2	13.1	67.5
73	24	167.6	59	112.9	104.9	107.6	46.3	43.5	19	39.2	8.6	12.6	14	84.7
74	28	172.7	96	103.2	102.6	100.6	40.1	33.1	5.5	26.9	2.5	3.1	2.8	67.1
75	26	165.1	65	98.6	97.4	101.2	46.6	40.9	6.2	33.3	3.6	1.7	2.3	71.5
76	26	170.2	75	109.9	107.6	102.1	40.2	30.6	8.1	26.4	1.8	8	7.9	65.7
77	27	177.8	65	99.1	111.6	88.8	45.1	39.3	14.3	42.8	9.6	14.9	12.8	94.9
78	30	160.0	60	106	114	93.0	47	44.1	21	41	7.8	8	8.5	87.2
79	26	165.1	60	120	121.1	99.1	44.8	43	12	40.1	9.7	13	13.2	89.5

80	25	165.1	65	110	125	88.0	44.5	43.1	21	43.2	10	14.2	14.4	97.1
81	28	162.6	66	112	102	109.8	43.9	42	23.1	39.6	7	8.7	8.9	90.2
82	25	170.2	70	115.6	116.3	99.4	44.1	37.9	12	36.5	8.7	10.6	12.3	82.8
83	27	177.8	72	107.6	112.2	95.9	47.9	43.3	15.7	39.6	8.9	8.7	9.8	82.7
84	26	167.6	62	115.6	109.7	105.4	53.4	45.8	12.9	34.5	8.3	9	9.9	64.6
85	29	160.0	63	109	120	90.8	47.7	45	13.3	33	7.9	8.9	8.7	69.2
86	31	162.6	65	115	117	98.3	51.1	49.1	12.7	35.1	7.6	8.9	8.6	68.7
87	28	170.1	59	116	118	98.3	43.5	41.3	15	39.9	8	9.9	9.7	91.7
88	29	167.6	57	97.7	111	88.0	46.9	43.6	17.8	33.3	8.3	8.9	9.1	71.0
89	28	157.5	63	106	129	82.2	53	46	14.5	38	6.9	7.8	7.5	71.7
90	28	167.6	59	120	121	99.2	49.8	48.1	19.9	39.9	5.6	7.6	7.2	80.1
91	23	167.6	61	110	112	98.2	47.7	45.6	16.6	29.9	5.4	6.9	7	62.7
92	27	180.3	67	104.6	97.2	107.6	46.5	41.6	16.8	34.9	5.7	9.1	9.5	75.1
93	23	165.1	56	99.9	119	83.9	39.6	38.6	14.6	29.9	4.9	5.9	5.7	75.5

94	25	167.6	66	110	121	90.9	40	37.1	18.3	43.3	7.6	8.8	8.5	108.3
95	26	165.1	65	121	122	99.2	45	43.3	19.8	45.5	7.7	8.5	8.6	101.1
96	27	160.0	55	116	120	96.7	43.3	39.7	16.6	37.6	6.8	8.6	8.8	86.8
97	32	160.0	59	96.6	109	88.6	39.8	35.5	16.6	27.8	5.6	8.3	8.1	69.8
98	26	172.7	70	89.9	100.7	89.3	44	40.2	16.2	32	7.1	8.1	8.6	72.7
99	25	170.2	80	115.1	117.3	98.1	50.1	44.9	16.9	43.7	10	11.1	11.3	87.2
100	29	160.0	58	117	120	97.5	48.1	47.1	15.8	39.7	9.1	10.9	10.8	82.5

Formula used for the analysis

Arithmetic Mean

The most widely used measure of central tendency is arithmetic mean, usually referred to simply as the mean, calculated as

$$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

Standard deviation and standard error

The standard deviation (SD) is the positive square root of the variance, and calculated as

$$SD = \sqrt{\frac{\sum X_i^2 - \frac{(\sum X_i)^2}{n}}{n-1}}$$

and SE (standard error of the mean) is calculated as

$$SE = \frac{SD}{\sqrt{n}}$$

where, n= no. of observations

Minimum and Maximum

Minimum and maximum are the minimum and maximum values respectively in the measure data and range may be dented as below

Range = Min to Max

and also evaluated by subtracting minimum value from maximum value as below

Range = Maximum value-Minimum value

Median

The median is generally defined as the middle measurement in an ordered set of data. That is, there are just as many observations larger than the median as there are smaller. The median (M) of a sample of data may be found by first arranging the measurements in order of magnitude (preferably ascending). For even and odd number of measurements, the median is evaluated as

M= [(n+1)/2]th observation- odd number

M= [n(n+1)/2]th observation – even number

Student's t Test

Student's t-test was used to calculate the differences between the means of two groups

$$t = \frac{\bar{X}_1 - \bar{X}_2}{SE}$$

where,

$$SE = \sqrt{S^2_X \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}$$

S^2 is the pooled variance and n1 and n2 are number of observations in group 1 and 2 respectively. The degrees of freedom (DF) is calculated as

DF = n1 + n2 – 2

Chi-square test

The chi-square (χ^2) test is used to compare the categorical data as

$$\chi^2 = \Sigma\Sigma \frac{(Fij - fij)^2}{fij}$$

where, Fij is the observed frequency while fij the expected frequency. The degrees of freedom (DF) is calculated as

$$DF = (r-1)\,(c-1)$$

Statistical significance

Level of significance "*P*" is the probability signifies level of significance. The mentioned *P* in the text indicates the following:

P>0.05-Not significant (ns)

P<0.05-Just significant (*)

P<0.01-Moderate significant (**)

P<0.001-Highly significant (***)

Annexure – VI

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Document Information

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W	URL: https://www.ajol.info/index.php/ijma/article/view/177213/166572 Fetched: 6/12/2020 3:15:29 PM	1
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